CTOBER 30, 1941

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OVERHEAD TRAVELING CRANES

OCTOBER 30, 1941
VOL. 148, NO. 18

This Week in . . . THE IRON AGE

Editorial
Skyscraper Scheduling 27

Technical Articles
Report, M.I.T. Powder Metallurgy Conference 29

Report of Twenty-Third A. S. M. Metal Congress:
Exposition Highlights, Activities of Societies 36
Meetings to Speed National Defense 41
Structure, Formation Rate of Pearlite 45
A.W.S. Reviews New Welding Developments 50
A.I.M.E. Studies Light Metal Technology 55

Gear Makers Examine Year's Developments 59

Features
Assembly Line 62
Washington 66
The West Coast 70
Fatigue Cracks 72

News and Markets
This Industrial Week 76
News of Industry 79
Government Awards 97
Personals and Obituaries 102
Construction Steel 106
Machine Tool Activity 108
Non-Ferrous Metals 109
Scrap Markets 110
Iron and Steel Scrap Prices 112
Comparison of Prices 113
Finished Steel Prices 114
Warehouse Prices 115
Sales Possibilities 120

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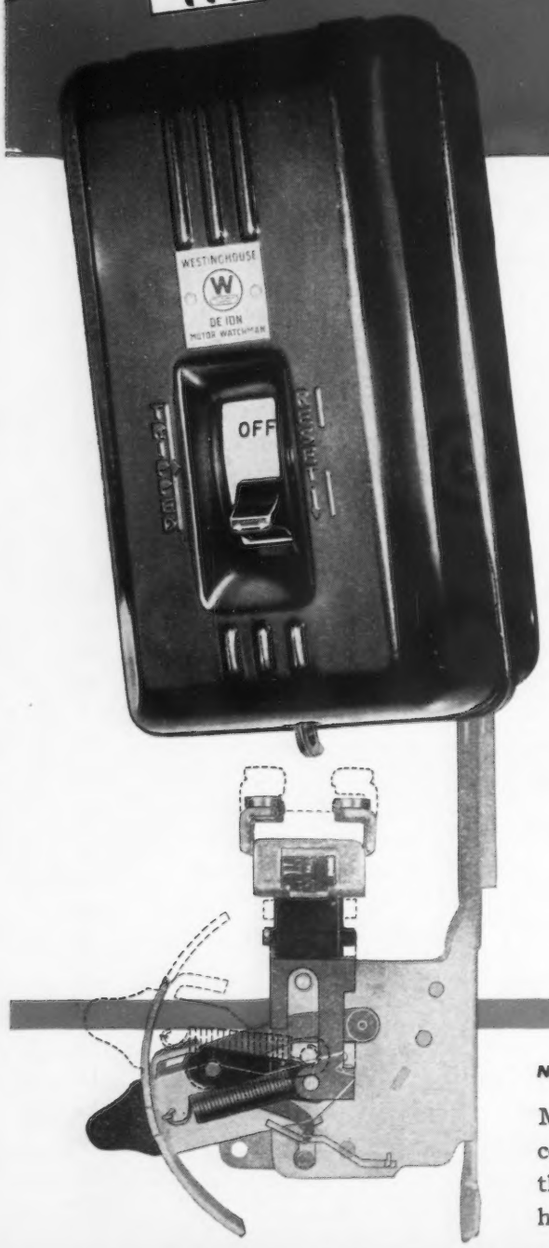
Products Advertised 124
Index to Advertisers 153

quick make-

AS WELL AS

"QUICK-BREAK" ACTION



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Quick-break opening of contacts on a manual across-the-line starter is essential to prevent dangerous arcing and burning of contacts. Not so well recognized is the fact that *quick-make* action is also an important factor in long contact life.

If contacts meet slowly, they start to carry full starting current before full contact pressure is reached. They may be "teased"—touched together but not latched, and then allowed to open, causing burning.

The "De-ion" Motor Watchman has both positive quick-make and quick-break action to doubly safeguard contacts against burning. Together with "De-ion" Arc Quenchers, Bi-Metal overload protection and interlocking covers, Westinghouse Starters offer longer life and lower maintenance costs with complete safety. It will pay you to investigate. Write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

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Motor Watchman toggle operating mechanism and movable contacts. When leverage passes center, spring tension gives the quick-make or quick-break action. Contacts cannot be held in dead center position, or "teased."

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"DE-ION" MOTOR WATCHMAN

THE IRON AGE

OCTOBER 30, 1941

ESTABLISHED 1855

Skyscraper Scheduling

SCHEDULING is a mighty important part of modern management of big enterprises. I do not see how we could get along without it.

Take the scheduling, for example, of the delivery of materials to a skyscraper building under construction in a big city.

Each day, materials for that particular day's work arrive on the job, or are perhaps delivered during the night before. Somebody has to figure that out and the fellows who do it have to know their business. They have to know just how much and what kind of structural shapes will be needed each day and how much cement and lumber and brick. And operations are scheduled too. Foundation to be completed on such and such a date, first floor structural on Sept. 8, 20th floor on Nov. 10, heating and plumbing on Dec. 14.

That is scheduling. And it works three ways. First, it enables a building to be completed in amazingly short time; second, it enables the material suppliers to serve many other customers while the building is going up, and third, it keeps the city streets open to traffic.

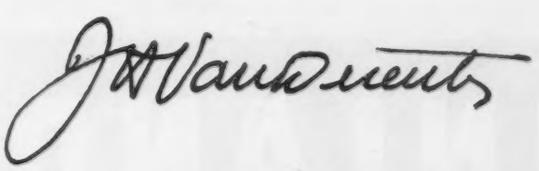
Just suppose, for example, that all of the structural steel, cement, bricks and other materials were ordered in a lump and all of them dumped in the streets before the foundation was dug. What a mess that would be!

Every large industrial or construction undertaking has to adopt scheduling. If it didn't, it wouldn't get things done. Or if they were done, they would be too costly and too late.

Suppose, for example, General Motors ordered all of its steel for a normal year's car production in a lump, without scheduling deliveries. Two million or more tons would be a lot to take out of the market at one time and would leave a great many smaller customers short. And I do not know where they would put it after they got it.

I think that part of the trouble we are having with shortages, particularly steel, is that priorities are being used, or at least have been very largely, as a substitute for the detailed scheduling of defense order requirements. Priorities have been used more or less as blanket orders.

If we scheduled our defense orders, so far as steel requirements are concerned, we would find enough capacity left over to keep our non-defense industries from starving in the midst of a sufficiency. And then perhaps we would not face the anomalous situation of seeing "recent shipments of British bicycles" advertised for sale in the United States when our own bicycle makers cannot get the steel and nickel to make them.



One Press Stroke Forms *This Difficult 9-In. Draw*

1. The blank is first formed to the contour of the lower die.

NOT a wrinkle mars the surface of this tapered deep drawn part. The draw, made in one stroke, is 9 in. deep at the crown. The taper in 16 in. is from 5 in. at one end to 1¼ in. at the opposite end.

The cold rolled deep drawing stock gauges 0.048 in. It is first rotary trimmed to an oval blank, measuring 17½ in. x 25 in. It is then preformed to the contour of the lower die. Before each stroke of the press the upper side of the blank and the metal holddown are coated with drawing compound. The punch drives down 9 in. When kicked out of the press, each part is perfectly formed without the least sign of a wrinkle up to the shoulder of the narrow flashing.

Breakage? The record is less than three out of one thousand draws. These parts are made of Inland Cold Rolled Deep Drawing Steel.

2. One stroke of the press draws the steel 9 in. deep.

3. Although formed 5 in. wide at one end, and 1¼ in. wide at the opposite end, there is no wrinkling at the narrower end.

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Powder Metallurgists Debate Techniques

o o o

—Second M.I.T. conference develops specific information and detailed data on manufacturing and processing methods and on new applications.

o o o

THE second powder metallurgy conference at the Massachusetts Institute of Technology, Sept. 25 and 26, under the direction of Professor John Wulff of the Department of Metallurgy, was a highly informative affair, there being 13 formal papers. The papers revealed specific information and detailed data on manufacturing and processing methods and on new applications in the field of powder metallurgy. This year's papers were of a particularly high standard. The aim of the meeting was to exchange ideas freely and to report on progress in the art during the last year. R. P. Koehring of Moraine Products Co. aptly summarized the goal of powder metallurgy on the production of something better than the material turned out by ordinary methods at the same or reduced costs.

The conference was divided into two sections, each covering one day. The first day was devoted entirely to problems connected with the powder metallurgy of iron and steel, while on the second day papers on refractory metals and on general academic problems were presented. This report deals with both parts of the meeting.

After a welcoming speech by John Wulff, in which he pointed out that today technical rather than financial problems are responsible for the industrial development work in this new field, the meeting was turned over to the first chairman, Frances Clark of Western Union.

A. H. Allen, Detroit Editor of *Steel* gave a brief and general paper on "Iron Powder." The great decrease in Swedish sponge iron imports has called for a close survey of the iron powder potentialities of the United States. Today's trend was described as away from the ore as raw material and towards the use of iron oxides as the basic material. In this connection oxidized scrap, scale, pickling residues or by-products of iron oxide originating from sulphur production were mentioned. In the latter case sulphur and iron oxide are obtained by chlorine treatment of pyrites. Of particular advantage in this process is the fact that hydrogen is also obtained as a by-product thus facilitating greatly the production of iron powder.

Carbonaceous agents, either solid or gaseous, were suggested as reducing media. Seven methods of making iron powder were mentioned, namely:

(1) Horizontal furnace for reduction of scale.
(2) Vertical retort furnace with external heating.
(3) Vertical retort furnace with internal heating.
(4) Low-temperature reduction in pressure vessels.
(5) Carbonyl powder production.
(6) Electrolytic methods using ferrous waste as starting material.
(7) Converter method coupled with a deoxidizing anneal.

In selecting the right method the tonnage market in competition with the blast furnace must be considered.

Of specific interest is method No. 4 applied on East Texas ores. A reduction temperature of 1400 deg. F. is used and natural gas at 50 lb. per sq. in. pressure is employed in a pulsating fashion as reducing agent. Fuel costs have been found to be one-quarter and plant investment one-eighth of the corresponding cost for blast furnace operation. During the discussion of powder characteristics the question of purity, shape and malleability were

especially emphasized. Today's iron powders were divided into four classes of purety, namely:

(1) 99+ per cent material, with applications in the bearing field and for precipitation parts.

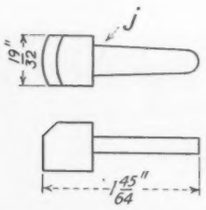

FIG. 1—Bronze weight used in a rotating machine; this must be very ductile. A two-plunger operation was found necessary. At first the density was only reached in the head and arm, while the joint "J" remained weak. By introducing less powder into the arm section of the die and by controlling the positon of two plungers, the density could be equalled throughout the entire cross-section. Two pressing and two heat treating operations were found to be necessary.

(2) 96 to 99 per cent material for machine parts in general.

(3) 93 to 96 per cent material for parts requiring little control.

(4) 93 per cent and less for applications where impurities are desired.

In connection with the purity the price factor must be considered. Price ranges of 8 to 12c. per lb. finished iron powder was mentioned. The problems of particle shape and malleability and hardness are closely connected with raw material and production methods.

In this connection, a new process was mentioned* wherein low carbon, high phosphorous steel turnings of the type SAE X1112 are crushed in a swing hammer to coarse flakes then compacted at 30 tons per sq. in. pressure, sintered at 1875 deg. F. and immediately hot pressed in water cooled dies. The material is then quenched, annealed, and cold coined. This process is used for a 3-in. diameter lock sleeve ring ball bearing holder for the Chevrolet motor, previously made from cast iron. The new material has a strength six times that of cast iron, is substantially harder and shows no wear whatsoever.

Steel, May 26, 1941, p. 76.

Ferrous powder metallurgy may have a profound influence on the present state of conversion of United States industries from peacetime to wartime production. For example, brake cylinders and pistons in automobiles, formerly made of aluminum, could be readily developed from iron powders.

In summarizing the advantages and disadvantages, a bright future was predicted for iron and steel parts of close tolerances, for prelubricated parts, for parts with improved resistance to wear, for parts of complicated shapes where machining costs can be saved, and for alloy steels of special characteristics not obtainable by orthodox methods.

However, certain restrictions in sizes and shapes of the briquetted parts, the relatively high costs of tools and equipment and the fact that no universal iron powder exists which would be useful and satisfactory for all cases with specific applications together with the big problem of production of tons of voluminous matter, such as powdered iron, must not be disregarded. The successful solution of these last problems alone will bring the expected boom in powder metallurgy of iron and steel.

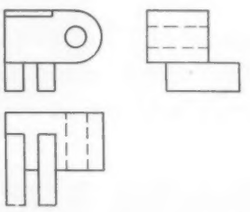

FIG. 2—A steel part, the desired tolerance being 0.005 in. which could be reached by repressing the part twice after sintering.

Included in the discussion of this paper were questions of price, quality, production methods and specific properties. The permeability and Q-value of iron for the radio industry was mentioned particularly. H. E. Hall (Metals Disintegrating Co.), E. E. Schumacher (Bell Telephone Co.) and C. Claus (Bound Brooks Bearing Co.) emphasized shape and insulation of particles and the influence of different types of impurities. F. V. Lenel (Moraine Products) mentioned the extreme desirability of obtaining an iron powder which shows great malleability during pressing with no tendency to deform during sintering. The discussion was concluded by statements advanced by J. Wulff, McNally, and W. Pratt in connection with sintering phenomena, such as shrinkage, surface tension, diffusion, and contact areas as a function of different particle shape and particle size distribution.

John Wulff presented a brief paper on a new method of making parts of stainless steel powder. Extensive research and careful study of the thermodynamics and physical chemistry of the chromium - iron - nickel - system has convinced him that diffusion rates of pure chromium and nickel are too low to be of importance for industrial powder metallurgical purposes. For this reason, the development of stainless steel parts from virgin metal powders was outruled, and experiments were made with a substantially austenitic alloy powder obtained from stainless steel scrap.

Scrap in the form of grindings, turnings or stampings was subjected to a preliminary precipitation heat treatment at temperatures between 500 deg. and 800 deg. C. During this treatment impurities and carbides are precipitated at the grain boundaries. After cooling, these grain boundary regions can be corroded provided that the differential in the potential between the boundary areas and the crystals is sufficient. A corrosion treatment of the heat-treated scrap in a solution of 3 per cent copper sulphate plus 3 per cent sulphuric acid removes the network and yields a stainless steel powder consisting substantially of single crystal particles of high ductility. The rate of corrosion is controlled by the thickness of the scrap, and the particle size of the resulting powder is controlled by the grain size of the initial material and is not influenced by the precipitation treatment. The cooling rate is also an important factor in the control of the particle size.

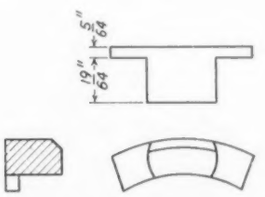

FIG. 3—In this bronze part difficulties were encountered with compressibilty and flow of powder. The usual compression ratio of approximately 3:1 did not apply in this case, and the flow of powder caused shear effects and non-uniformity of density. Attempts to cold form the bevel during repressing failed. This problem was solved by using the right type of powder.

Size distribution can be con-

trolled by selecting the proper scrap material, and powders may be obtained with as little as 10 per cent of 325 mesh or may pass compietely through a 325 mesh sieve. Apparent densities of the powder range between 2.9 and 3.6 gm. per cu. cm. The stainless steel powder thus obtained can easily be compressed and sintered. Densities of 7 are obtained after pressing at 35 tons per sq. in. After sintering at 1250 deg. C. compacts have a tensile strength of 40,000 lb. per sq. in. and 22 per cent elongation while compacts of the same powder sintered at 1375 deg. C. yield a tensile strength of 62,000 lb. per sq. in. 48 per cent elongation. The latter figures are of a remarkable magnitude for a sintered metal. However, such peak values can only be obtained if a proper atmosphere is used during the sintering operation. Hydrogen has been found most suitable but must be carefully cleaned and dried. Besides the customary drying and catalyzing of the hydrogen, the introduction of special getters in the hydrogen train or next to the charge in the sintering furnace is recommended. Titanium hydride was emphasized but during the discussion the use of metallic calcium chips was also suggested.

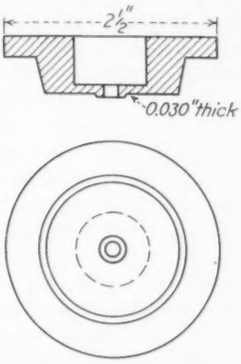

FIG. 4—Disk shaped piece has four different thicknesses, the center being 0.030 in. The tolerances are very close, with maximum variation of only 0.002 in. permissible. At the beginning 10 per cent shrinkage occurred during sintering, there being at the same time an expansion of the thin center section. Also, this thin center part was extremely difficult to press, frequent facturing being encountered until a powder of greatest uniformity in particle size distribution was used. Flow of powder did no harm in this case.

In conclusion some extraordinary properties of such sintered stainless steel were mentioned. Compacts were completely densified by reducing them 8 per cent under a 400 lb. forging hammer after sintering at 1250 deg. C. This material yielded 80,000 lb. per sq. in. tensile strength and 60 per cent elongation. Another proof of the amazing ductility of this stainless steel was offered by the statement that ordinary steel strip when coated with the stainless steel powder by means of a spraying gun and then heat treated, endured a 165-deg. bend without injuries to the stainless steel coat.

In the discussion, the corrosion resistance of the raw material was explained further. Various corroding agents were discussed, but it was agreed that sulphur-containing agents were most suitable. In this connection, Professor Wulff stated that his process is not only adaptable for stainless steel but also for a number of other materials. As an example he mentioned the possibility of corroding grain boundaries of Armco iron by an ammonium persulphate dipping process. The resulting iron powder is of a uniform particle size and of globular particle shape, resembling the characteristics of carbonyl iron.

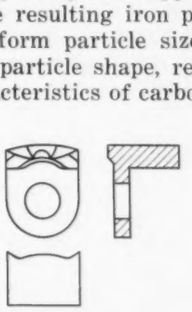

FIG. 5—This steel composition part is used for wear resistant purpose. Wear resistance of this material was found to be superior to that of standard material, although other physical properties probably were lower.

However, the price of such a product would be in excess of carbonyl.

Another item discussed was the machinability of the sintered stainless steel in case semi-finished parts are produced. The metal has free machining properties due to the presence of a large number of minute pores in the sintered stainless steel which tend to break the chips.

The question of diffusion rates of pure chromium and nickel in sintered and mixed powder compacts was also discussed. Pressing and sintering experiments in vacuum with mixed powders carried out here and abroad were mentioned, but the commercial applicability of these methods remained doubtful.

R. P. Seelig, of Powder Metallurgy, Inc., then presented a most interesting paper on the pressing technique of "Dense Powder Metallurgy Parts." The term "dense" was used by the author to distinguish from porous parts made by the bearing manufacturers and automobile industries for self-lubricating purposes. While such parts display as much as 25 per cent porosity by volume, parts described by Mr. Seelig have an average overall density of approximately 90 per cent and may be considered "technically" dense.

The paper was chiefly concerned with mechanical problems in connection with molding parts of rather complicated shapes, but no values for the final properties of these parts were given. The information advanced in this paper may be considered a continuation of an article published by the same author in the December 1940 issue of *Metals and Alloys*. The pressing of a considerable number of parts of more or less complicated contours was discussed and illustrated by sketches projected on a screen. See Figs. 1 to 6 herein.

In conclusion some basic principles of pressing were briefly mentioned. The author has been successful in developing dies and working out pressing methods adaptable for a 200-ton hydraulic press for the manufacture of relatively dense parts of very complicated shapes. This achievement represents considerable progress in the advancement of the art of powder metallurgy in general, since until now such intricate pressed metal parts were only thought possible with porous metal parts of the self-lubricating bearing type.

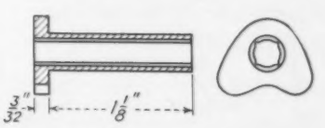

FIG. 6—Eccentric part, where the problem of powder filling into the die was found to be very difficult. The pressing was carried out by means of a special core, 4 in. long, the core being guided in both punches. The main difficulties were due to the fact that no taper was permissible.

During the discussion, which was led by Professor De Forrest and supported by R. P. Koehring of Moraine and A. Langhammer of Amplex, the questions of wear and ductility of the powder compacts, as well as the question of limita-

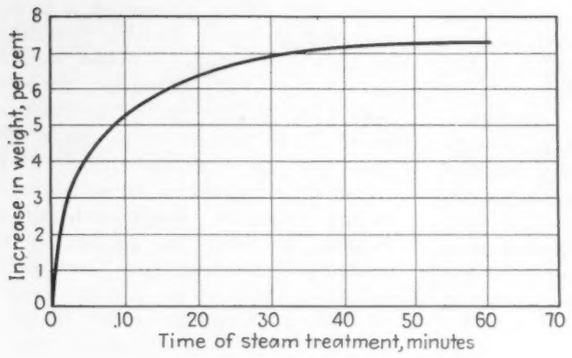

FIG. 7 — Weight increase during steam treatment. Initial briquetting pressure = 20 tons per sq. in. Sintering cycle = 2000 deg. F., 1 hr. steam treating temperature at 1075 deg. F.

tions in dimensions and durability were debated. It was agreed that powder products in general show superior wear resistance as compared with cast or wrought metals. The importance of the commonly known lack of ductility of metal powder parts was minimized by Professor De Forrest, who claimed that ductility of metals is only a safety device which has to function if the design fails. On the other hand, an ideal design would not require ductility of the metal. This statement, of course, was hotly debated by powder metallurgists and mechanical engineers alike. However, it was agreed that a revamping of the design of many machine parts to simpler contours would facilitate the use of power metal parts to a much greater extent. Finally, the question of production and reject rates was introduced and, although Mr. Seelig claimed that reject rates were normal, it became evident that production rates in his case were very low, probably only in the order of a few thousand pieces. For this reason, questions of die wear and replacement remained unsolved during the discussion.

The afternoon session, under the chairmanship of Mr. Schumacher, Bell Telephone Co., covered three papers concerned with the processing of iron powders.

F. V. Lenel, of Moraine Products, presented a paper on a new method of manufacturing extremely hard and wear resisting, self-lubricating iron parts to be used for guides in saw blades, rollers, for drawers in furnaces and refrigerators or vanes in Diesel fuel pumps. The method described by Dr. Lenel involves a steam treatment of porous sintered iron or iron-carbon parts. Such parts are produced in much the same manner as the oil pump gear process. After sintering the parts at 2000 deg. F. they are enclosed in a chamber and subjected to a steady flow of steam. The container is placed in the furnace and kept for 1 hr. at 1075 deg. F. As a result of this treatment the walls of each cavity or little channel are transformed from iron into oxide layers. During the treatment oxide layers which adhere tightly to the particles and assume the form of corrosion protective skins are also formed. After the formation of these skins they quickly become impervious to further attack by the water vapor as the reaction rate is self-stopping. As a result, a skeleton of magnetic iron oxide is generated throughout the iron or iron-graphite powder compact. The amount of iron oxide formed may reach as much as 30 per cent. In the case of a 98-2 iron-graphite combination, the resulting structure shows an intimate mixture of ferrite and pearlite interrupted by occasional inclusions of bulk cementite or graphite and interwoven throughout the entire cross-section by a network of cavities and oxide streaks. In certain regions oxide could be seen adjacent to pearlite areas giving evidence that at the heat treating temperature employed little reaction took place between the carbon and the oxygen.

In conclusion a brief summary of the properties of this material was given, and some of the test results are shown in Figs. 7 and 8 herein. An increase of 10 to 50 tons per sq. in. in the molding pressure improved the density from 5.1 to 6.6, decreased the porosity as measured by the percentage of oil absorption from 5.75 to 2.11 and decreased the gain in weight due to the oxidation from 12.1 to 1.6 per cent. Hardness tests carried out on the same new material showed a rise for the straight sintered metal from Rockwell E 37 for the low pressed material to Rockwell B 68 for the high pressed material. On the other hand, steam treated material displayed hardness values in the neighborhood of Rockwell B 100, more or less independent of the initial molding pressure. Tensile strength values were found to be somewhat below values obtained with straight sintered material, namely for 22,000 lb. per sq. in. for steam treated sponge iron versus 28,000 lb. per sq. in. for sintered metal. For an iron-graphite combination based on decarburized, finely ground iron-carbon alloy, the corresponding tensile values were given as 41,000 lb. per sq. in. for the steam treated material and 46,000 lb. per sq. in.

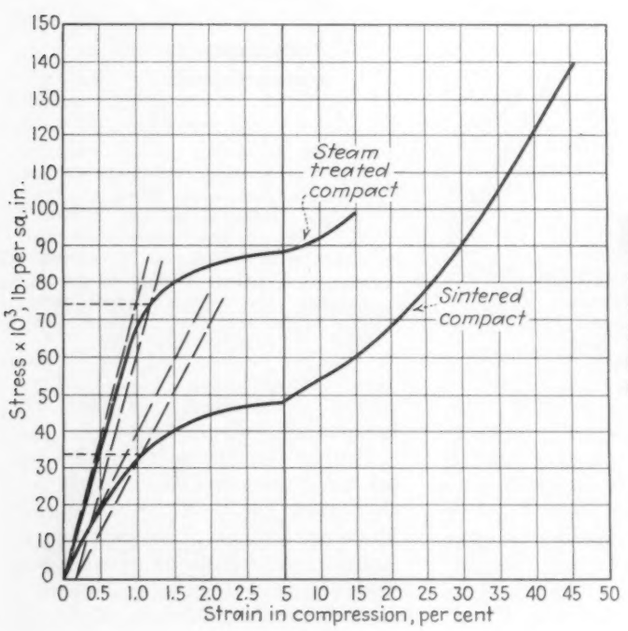

FIG. 8—Compression test of sintered and steam treated compacts. Strain-stress diagrams as taken with a recording instrument.

for the sintered metal. Under compression, the steam treated material showed a yield point of approximately 80,000 lb. per sq. in. in comparison with sintered metal with a yield point of about 40,000 lb. per sq. in.

The general behavior under steam was found to be the same for all kinds of iron. It was recommended to make use of the porosity by filling the pores with oil after steam treatment. The oxide particles offer great protection against corrosion and wear. The corrosion resistance of this new material is in fact considerably better than that of straight sintered iron. While the latter showed rust after a few days of storage, in a moist atmosphere, the steam treated metal showed no rust after months of storing under similar conditions. The behavior of the material under shock, its heat conductivity and flow under friction and its creep characteristics were questioned during the discussion. However, these properties were considered of minor importance in view of the excellent rigidity and hardness of the material.

R. P. Koehring, of Moraine Products delivered in the next paper on "Hot Forging of Iron Powder Briquettes." In the introduction, Mr. Koehring described three processes for making iron and steel parts from powders, namely:

(1) Cold pressing, sintering, sizing (cold-pressing).

(2) Cold prepressing, hot pressing in heated dies, annealing.

(3) Cold pressing, sintering, immediately followed by hot forging in cooled dies, annealing.

The selection of the procedure depends on questions of economy as well as the physical properties desired for the final product. While the process under (1) facilitates a high production rate, the material turned out shows low strength and ductility characteristics. On the other hand, the processes mentioned under (2) and (3) necessitate much lower production rates but yield materials of considerably improved strength and other physical properties.

The author described the procedure and results of some laboratory scale experiments according to method (3). Five types of raw material were used, namely:

(1) Steel turnings of the type used in the process described earlier by A. H. Allen.

(2) Decarburized steel powder—100 mesh.

(3) Same material as (2) but mixed with 0.6 per cent graphite powder.

(4) Iron powder obtained by reduction of mill scale—100 mesh.

(5) Same material as (4) but mixed with 0.6 per cent graphite powder.

Compacts were heated at 2000 deg. F in a Globar furnace for 1 hr. A protective atmosphere of hydrogen was used for the pure iron powder, while the iron-carbon combinations were heated in a closed box filled with carbon.

The microstructure of the forged material disclosed a decarburization of approximately 50 per cent in all iron-carbon compositions. The following table gives some final physical properties:

Material	Density	Tensile Strength, Lb. Per Sq. In.	Yield Point, Lb. Per Sq. In.	Elongation in 2 In., Per Cent	Reduction in Area, Per Cent	Rockwell "B" Hardness
1	7.79	54,400	38,100	11	13	59 to 74
2	7.82	55,200	37,800	14	13	61 to 68
3	7.78	73,300	51,200	23	32	64 to 75
4	7.39	39,900	33,000	3	3	67 to 82
5	7.39	44,700	36,900	4	5	66 to 74

For the experiments a forging die was used that gave sufficient pressure to result in high density. Sponge iron did not give a good performance with this technique. If close tolerances were desired, the cold pressing method was used because of better control, otherwise hot pressing was employed.

In conclusion the author observed that for a porous product with close tolerances material (1) performed best while for optimum strength characteristics, materials (2) and (3) were best. The relatively low values obtained for metal made from the reduced iron oxide were somewhat surprising.

C. G. Goetzel, of American Electro Metal Co., delivered the final paper of the afternoon session of "Hot-pressing of Iron Powders."

This paper may be considered as a continuation of Mr. Koehring's paper, covering method No. 2. Of Mr. Koehring's contribution. The paper was essentially a review of information given in an article published in THE IRON AGE, Sept. 4, 1941.

In the discussion of the last two papers, questions of production rate and possible applications for such high strength iron parts were debated. Mr. Koehring made the encouraging statement that 400 to 600 pieces per hr. could be produced by forging with the possibility of still increasing the production rate. On the other hand, it was agreed that production rates in the case of hot pressing must be lower, as in this case the time factor cannot be neglected. An explanation was given for the peculiar fact that in the experiments on hot pressed iron, the Swedish sponge compacts showed distinctly greater resistance

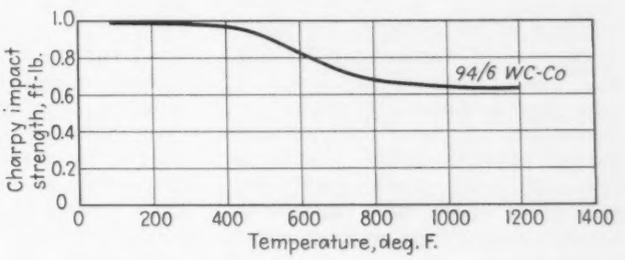

FIG. 9—Impact resistance of tungsten carbide at elevated temperatures.

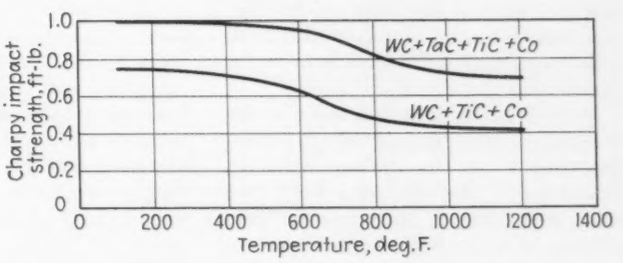

FIG. 10 — Impact resistance of multiple carbides at elevated temperatures.

to compression at elevated temperatures if compared with the basically purer electrolytic or hydrogen reduced iron. The reason for the lack of plastic deformability at high temperatures may be seen in the presence of a large amount of film-like impurities in the Swedish iron which interfere with the flowing tendency of the metal proper. The question of the die wear during hot-pressing and forging was also discussed. No reliable figures could be given by the authors but it was mentioned that with the proper selection of die material, especially in the case of water-cooled forging dies, the lifetime of the dies may come close to that of cold-press dies. Dense iron parts of complicated shapes requiring close tolerances and ordinarily much machining were given as the main application for hot worked iron powder parts in the future.

The morning session of the second conference day was under the chairmanship of John Wulff and was concerned with papers of high theoretical standard.

P. E. Wretblad, of Fagersta Steel Works, Sweden, presented an excellent paper on the "Mechanism of Sintering." He offered a very explicit definition of sintering as "the process in which solid bodies become bonded by atomic forces"; no suppositions concerning temperature, pressure, phase changes and the like are made. An ideal case for a complete sintering of two surfaces is visualized in which the original boundary loses its identity and becomes not a grain boundary but just another crystal plane. The conclusion is drawn that fundamentally, neither pressure nor temperature is essential to effect sintering. Crystallization phenomena such as recrystallization, grain growth as well as shrinkage are traced to diffusion rather then to surface tension or chemical reactions.

In the following discussion, a general review of present-day conceptions of sintering was led by Professor Wulff and Professor Cohen of M.I.T., by Professor Emmet of Johns Hopkins University, and supported by others. The question of the effects of molding pressure, sintering temperature and time were thoroughly reviewed and reference was made to earlier papers by Trzebiatowski in Poland on sintering experiments and by Eberhardt in Vienna on studies on porous and colloidal powders by means of an electron microscope.

Finally the question of cracks in compacts was raised and discussed by L. H. Bailey of Stokes and F. C. Kelley of General Electric in connection with design in general.

P. H. Emmet then presented a paper on "Adsorption Isotherms of Fine Powders." The paper referred to investigations carried out in connection with catalysts of porous iron. The principle of the new method developed involves adsorption of gases such as nitrogen or argon in metal powers. The method is applicable to particles 20 microns or smaller. No lower limit has been found as yet. The method is especially adaptable for powders with particles in which crystallites of the order of one micron and smaller are grouped in three-dimensional chess-board fashion. A particular advantage of the method is, that it can be applied without destroying the catalyst powder.

A simple glass apparatus was used. Non-absorbent helium was first filled into the measuring tube. Nitrogen was then introduced which was absorbed by the powder. The adsorption isotherms are simply obtained by differentiation for different pressures employed.

The method was successfully applied on various types of carbon, on zinc oxide pigments, on nickel and nickel oxide and on iron and copper catalysts. In addition, some experiments were made with tungsten powder of an average particle size of one micron.

The preparation of a sample prior to its introduction in the sampling tube is simple. If the sample is non-oxidizing an evacuation at 110 deg. C. to remove moisture is sufficient. If the sample is metallic, oxide films should be removed by hydrogen reduction, and the sample must then be evacuated to remove gases. If a gas, such as oxygen is used as absorbent, then, naturally, oxide films must be removed before testing.

The application of the method in general is only for material having particles smaller than 20 microns in diameter. However, if the apparatus is connected with a McLeod gage, particles larger than 20 microns can also be measured successfully. However, the method is restricted to porous particles and cannot be used for solid particles since in that case only the surface area can be determined. But, by means of differentiation of the results obtained by this method and by ordinary methods of particle size determination, a measure of particle porosity could be obtained.

During the discussion, questions of uniformity of particle size and the applicability to metal powder mixtures were raised and it was indicated that this method is only good if a material of close particle size range is used, as only average particle size range can be obtained otherwise.

F. N. Rhines, of Carnegie Institute of Technology, next read a theoretical paper on "Homogenization of Sintered Copper-Nickel Alloys." The diffusion laws in the copper-nickel solid solution system were investigated, and mixed powders obtained from the Metals Disintegrating Co. were used as the basic material. The powders were pressed at 30 tons per sq. in. to approximately 90 per cent density and sintered at various temperatures, mostly around 1000 deg. C. Different ratios of copper-nickel, varying from 90-10 to 10-90 Cu-Ni were tested, and rates of homogenization of such materials were established. This same paper was presented in detail at the A.S.M. Metal Congress, Philadelphia.

Professor Rhines presented some equations to make his theories easily understandable to the audience. He proved that all Cu-Ni alloys will pass the same sequence of concentration changes. The shape of diffusion curves is characteristic of the alloy.

One of the most interesting points brought out during the discussion was Professor Rhines' statement that the rate of diffusion and homogenization of such powdered alloy compacts may only be slightly effected by the presence of cavities or inclusions, and that impurities may only retard the rate if they appear as films surrounding powder particles. The author expressed the belief that a possible retarding influence on the rate of consolidation and alloying of the cavities and impurities in metal powder compacts may be greatly exaggerated in the present conceptions of the mechanism of sintering.

In the afternoon session, four papers on refractory metals were presented under the chairmanship of Fred P. Peters, of *Metals and Alloys*.

H. H. Hausner and P. W. Blackburn's paper on "Compound Contact Metals" was presented by Mr. Blackburn of the American Electro Metal Corp. Some problems con-

nected with electric contacts had to be overcome and the authors described their experiments. One of these problems was the deterioration of the contacts by heat developed under constant carrying of high current or through arcing caused by the switching operation. Contacts which have been operated for some time show a transfer of material from one part to another. This is caused by electric sparking. It was possible under certain conditions to find contacts interrupting circuits without arcing. The critical current permits the circuit to be interrupted without producing an electric arc. The critical circuit depends to a great extent upon the material, surface condition and temperature of the contacts. For instance, an electric arc will be formed between silver contacts at a current only one-quarter as great as that needed between tungsten contacts. It was found that the physical requirements for heat-conductivity were quite great. Alloys in general did not make good contact material. However, this was overcome by employing powdered metals. The contacts thus produced showed satisfactory performance. The powder metallurgy method tends to combine the good conductivity of the silver-copper group with the other characteristics of the tungsten-molybdenum group. The latter material is pressed into the desired shape and sintered giving a body of the proper dimensions. The pores of this spongy form are then filled with melted silver or copper by capillary attraction. Another method is the pressing and presintering of tungsten and silver at a low temperature. Afterwards the material is shaped into its final form. Finally it is sintered at a high temperature to give the material the desired properties.

Photomicropictures were shown of Mo-Ag, W-Cu, W-Ag and W-Cu-Ni alloys of various compositions suitable as contact materials for oil circuit breakers. The sintering took place below and above the melting point of the binder. Density is an important quality of the compacts. It is dependent upon the initial pressing and sintering operation. Annealing after forging changed the density intentionally. Good contacts also require high hardness values. Tensile strength is of no great importance for contacts and varying the Cu-Ni contents of the material controlled the strength. The heat treatment changes the conductivity. A good contact must have no tendency to stick, weld, burn or pit. It must have permanency of shape and ease of brazing to the contact bodies.

The discussion was led by Dr. Hensel of Mallory who mentioned that contact metals had been developed with tungsten carbide as the basic material. In this metal, material transfer was kept to a minimum and found only if the metal was used with D.C. current. A discussion of the term "critical current" followed, and no definition could be agreed upon.

M. F. Rogers, of the Callite Tungsten Corp., gave a brief review of "Effect of Particle Size on the Microstructure of Cemented Tungsten Carbides." He explained that during the carburization process the outside particles may be carburized while pure tungsten can still be found in the center of the specimens. In that case, more carbon was needed. Cobalt was used as a cementing agent. Tungsten carbide of coarser grain had more film of matrix around the particles. Finer pieces had a correspondingly thinner matrix. The particle size is of importance for the reaction rate. The paper generally represented little news, except for some excellent photomicrographs of tungsten carbide powder particles taken under an electron microscope of 14,000 diameters magnifications; 325 mesh size was used for the single crystal pictures. Highest strength resulted in finest particle size powders. However, no physical tests were made.

The discussion referred mostly to the preparation of the photomicrographs shown and to diffusion rates and particle size effects.

B. W. Engle, of the Carboloy Co., then presented a paper on "Some Physical and Chemical Properties of Carbides after Final Sintering." This paper constituted one of the most comprehensive surveys in the refractory metal field. Values given in it represent the scope of decades of work and experience of the author. Besides the presentation of some well prepared photomicrographs, a huge amount of actual data on physical properties was given. Cemented tungsten carbides, cemented double carbides containing tungsten and titanium or tantalum carbide were investigated. The data thus represented were too manifold to be reviewed herein.

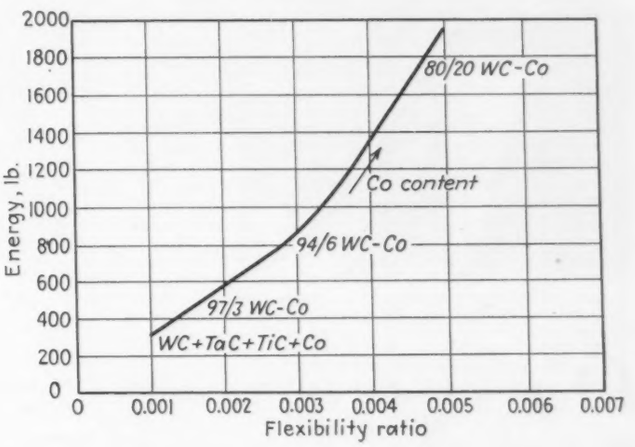

FIG. 11 — Toughness of cemented carbides.

The highlights of the paper were some remarks concerning corrosion resistance and some detailed information about the new Carboloy extrusion process. Demonstrated by the presentation of actual specimens, remarkable progress must have been made in this special field. Tubings of cemented tungsten carbides of approximately 3/8 in. outside diameter and 1/16 in. wall thickness and 12 in. to 24 in. long were shown, together with tungsten carbide rods and wires which were twisted into spiral forms. This makes probably one of the strongest spiral springs imaginable, especially so considering figures such as 1,000,000 lb. per sq. in. compressive strength and 100,000,000 lb. per sq. in. for modulus elasticity. See Figs. 9 to 11 herein.

Among a great number of known applications for the tungsten carbide materials three were especially emphasized, namely, Jewell

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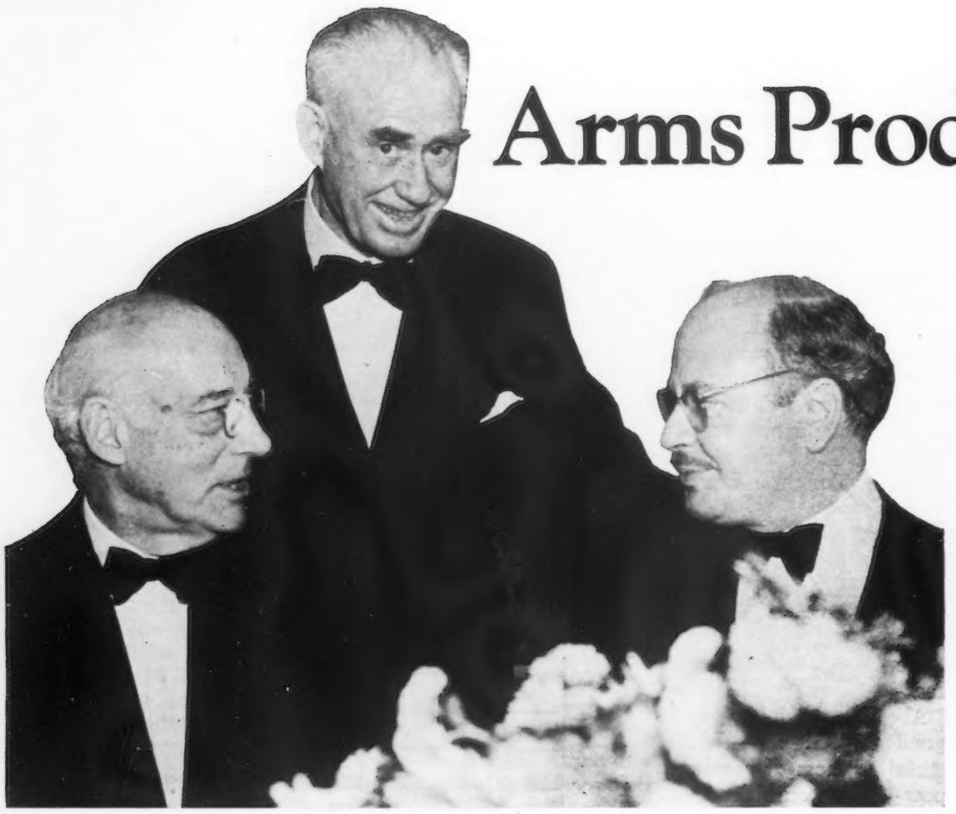
Arms Production



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. . . ASM president-elect Bradley Stoughton (left) talks over defense problems with retiring ASM president Dr. O. E. Harder (center) and William Shirer, radio commentator who spoke at the society's annual banquet.

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ONLY an elaborate exposition, such as the 23rd National Metal Congress and Exhibition held last week in Philadelphia could even in part tell of the dramatic dislocation now torturing the metal industry. In just 12 months the whole complex framework of American competitive industry has passed out of sight while the infant armament industry of a year ago has with bewildering rapidity spurted to a giant stature that now dominates the entire industry. This growth has been attended with all the natural aches and pains that accompany such an unnatural development. To the solution of these new problems the Metal Congress was well dedicated.

A cursory examination of last week's exposition showed the many exhibitors and visiting engineers going through the conventional motions of past years, with the notable difference that they were concerned not with problems of producing automobiles, refrigerators, milk cans or silverware, but with turning out guns, shells, tanks and the other equipage of modern warfare.

That the engineers and plant executives found their visit to the Congress profitable was evidenced by the heavy attendance at all the meetings and at the exhibits. This interest was especially strong at the daily Defense Forums where overflow crowds taxed the facilities of the meeting rooms.

The need for speed in the mobilization of industry for arms production was stressed by William L. Shirer, news commentator of the Columbia Broadcasting System and former Berlin correspondent, who spoke at the annual dinner of the American Society for Metals on Thursday evening at the Benjamin Franklin Hotel.

Shirer predicted that Russia would not be defeated this winter, even though the Red Army should be backed up against the Ural Mountains. The final outcome of the war and its duration, however, will be determined by the speed and efficiency with which America's industrial strength can be converted to arms production, he added. Shirer addressed one of the largest banquets in the history of the A.S.M., one at which over 1100 persons crowded the capacity of the ballroom.

The presentation of A.S.M. metals for outstanding achievement, a feature of the annual dinner, found six metallurgists honored for their work. The past-president's medal went to James P. Gill, chief metallurgist of Vanadium Alloys Steel Co., Latrobe, Pa., and a past president of A.S.M.

The Henry Marion Howe medal was awarded jointly to Marcus A. Grossman, director of research, Chicago district, Carnegie-Illinois Steel Corp.; Morris Asimow, metallurgist of Central Products Co., Los Angeles; and S. F. Urban, research supervisor, South Works, Carnegie-Illinois Steel Corp. Albert L. Marsh, president of Hoskins Mfg. Co., Detroit, was awarded the Albert Sauveur Achievement Medal.

Robert F. Mehl, director of the metals research laboratory and head of the department of metallurgy of the Carnegie Institute of Technology, was presented the Edward de Mille Campbell memorial lecture certificate.

The Campbell Memorial Lecture, which is published in this issue on page 45, fully lived up to the high standards established by previous lecturers. Dr. Mehl received his Ph.D. from Princeton University in 1924 where he served as Proctor fellow in chemistry. His academic experience also includes a term as head of the department of chemistry at Juniata College and as national research fellow at Harvard. From

Dominates Metal Congress

1927 to 1932 he was superintendent of the division of physical metallurgy, Naval Research Laboratory, and then assistant director, research laboratories, American Rolling Mill Co. He has been at Carnegie Institute of Technology since 1932.

Earlier in the week, at the society's annual business meeting, the following new officers were elected for 1942: President, Bradley Stoughton, professor of metallurgy, Lehigh University; vice-president, Herbert J. French, in charge of alloy steel and iron development, International Nickel Co.; treasurer, Francis B. Foley, superintendent of research, Midvale Co. New trustees chosen at the meeting were Norman Tisdale, metallurgical engineer Molybdenum Corp. of America, and Kent R. Van Horn, research metallurgist, Aluminum Co. of America.

The Metal Congress attacked defense production problems on three fronts and, judging from the general comments, succeeded admirably. The three phases of the attack were, first, that of greater efficiency in manufacturing processes, secondly, that of countering shortages by substitution, and thirdly, by having military and defense agency experts address the meetings and thus aiding the engineers, metallurgists and management executives present to better understand the scope of the defense program.

The daily defense meetings, which are reported elsewhere in this issue, covered such subjects as alloy steels and castings, shell production, copper and its alloys, the light metals, bearings and the inspection of metals. High officers of the Army, Navy and Ordnance departments turned out to view the exhibits and attend the meetings in large numbers.

Interest in the meetings of the American Welding Society centered largely upon research questions, but the practical problems of the use of welding methods in the defense program also came in for considerable attention. This was particularly true of the use of butt welding for aircraft work. Attendance at the welding sessions set a new record with more than 1500 persons registered during the week.

In recognition of the national emergency and the fine work its officers have been doing, the welding society reelected three of its three top ranking officers. Col. Glen F. Jenks, Ordnance Department, Washington, continues as president of the society; Klaus L. Hansen, consulting engineer, Harnischfeger Corp., Milwaukee, as first vice-president, and David Arnott, chief surveyor of the American Bureau of Shipping, as second vice-president. Mr. Arnott was also the recipient of the Samuel Wylie Miller memorial medal of the society this year. A new treasurer was elected in the person of O. B. J. Fraser, director of technical service, mill products division, International Nickel Co., New York. Miss M. M. Kelly continues as secretary of the society.

Newly elected district vice-presidents were: For New York and New England, Edward R. Fish, chief engineer of boiler division, Hartford Steam Boiler Inspection & Insurance Co.; Middle Eastern, A. G. Bissell, Bureau of Ships, Navy Department, Washington; Middle Western, Leslie S. McPhee, supervisor of welding, Whiting Corp., Harvey, Ill.; Southern, J. A. Hall, engineer of steel plate construction, Kansas City Structural Steel Co.; Pacific Coast, N. F.

C. H. JENNINGS, of Westinghouse, and chairman of the board of awards of the American Welding Society (extreme left) is shown with Col. G. F. Jenks, president of the A.W.S., presenting the Lincoln gold medal to Dr. R. H. Aborn (center), staff member of the research laboratory of the U. S. Steel Corp., Kearny, N. J. To the right of Mr. Aborn is David Arnott, vice-president and chief surveyor of the American Bureau of Shipping, New York, the recipient of the Samuel Wylie Miller memorial medal. At the extreme right is Dr. D. S. Jacobus, member of the A.W.S. board of awards.

Ward, associate professor of mechanical engineering, University of California.

New directors at large are: Fred L. Plummer, chief research engineer, Hammond Iron Works, Warren, Pa.; R. G. LeTourneau, president, R. G. LeTourneau, Inc., Peoria, Ill.; Frank B. Bolte, process standards engineer, Boeing Aircraft Co., Seattle, Wash., and Roger W. Clark works engineering laboratory, General Electric Co., Schenectady.

The regular fall meeting of the two metal divisions of the American Institute of Mining and Metallurgical Engineers—the Institute of Metals and the Iron and Steel Division—held in conjunction with the metal congress, was also exceptionally well attended.

The institute's annual fall dinner was held on Tuesday with Charles H. Herty, Jr., chairman of the Iron and Steel Division presiding, and Donald K. Cramption, chairman of the Institute of Metals Division responding. G. K. Bradfield, Jr., of American Car & Foundry Co., presented an illustrated talk on "Building Combat Tanks for the U. S. Army."

One of the interesting features of the institute's technical meetings

AMONG the recipients of A.S.M. medals for outstanding achievements in metallurgy were J. P. Gill, A. L. Marsh, M. A. Grossman and M. Asimow.

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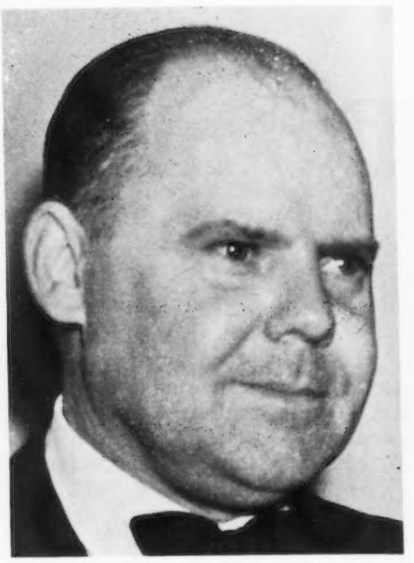
was the informal round-table discussion of order-disorder phenomena led by Dr. William Shockley, of Bell Telephone Laboratories, New York. A large number of the papers read at the technical sessions was devoted to the technology of the light metals, as magnesium, aluminum and their alloys. Several of these papers are abstracted elsewhere in this issue.

In the course of his discussion, Dr. Shockley explained, "It has been shown for a number of alloy systems that the atoms tend under favorable circumstances to arrange themselves in those orderly patterns technically referred to as superstructures. It has further been observed that many of the properties of such alloys depend upon the degree of order prevailing in them: for example, the resistance of Cu_3Au at room temperature may be

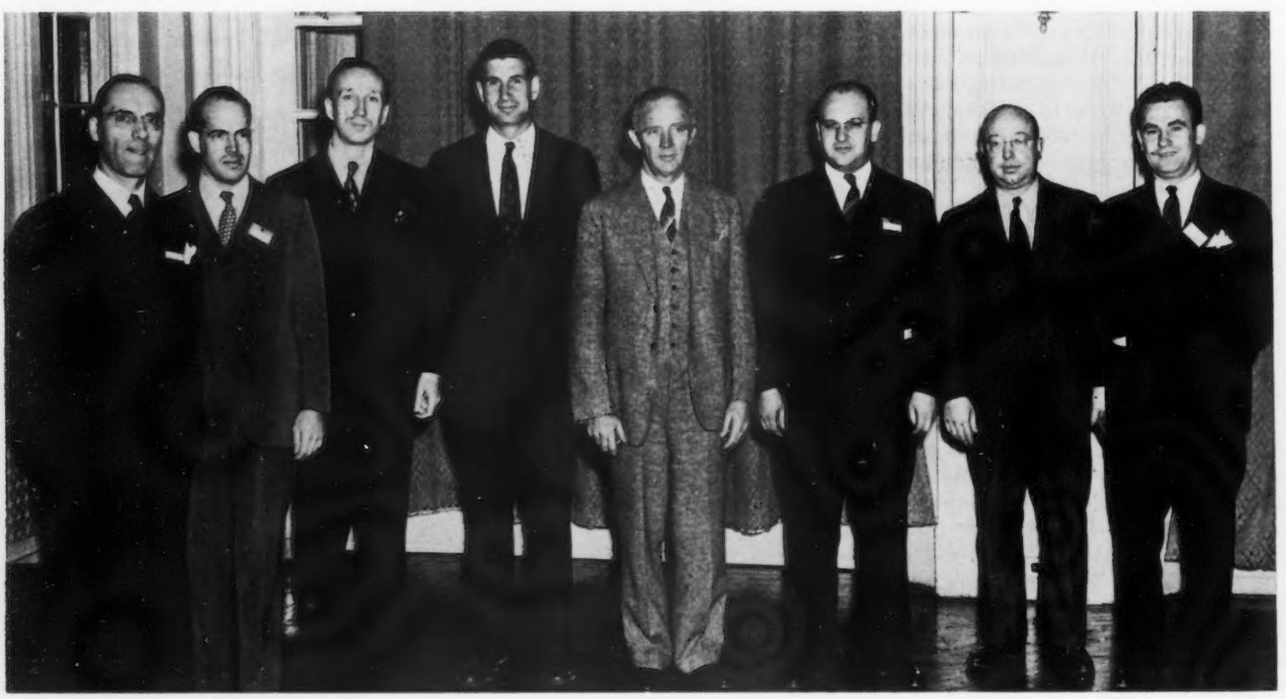


J. P. GILL

changed by a factor of three by controlling the degree of order.

"The foundations of the theory of order disorder transformations have now been confirmed in their general aspects by numerous experiments. However, almost no specific

SOME of the recipients of the Resistance Welders Manufacturers' Association prizes, presented during the AWS convention. From left to right: M. S. Clark, president of RWMA and of the Federal Machine & Welder Co.; G. N. Weygandt, Rensselaer Polytechnic Institute; G. S. Mikhalapov, Taylor-Winfield Corp.; John R. Fetcher, E. G. Budd Mfg. Co.; Prof. W. B. Kouwenhoven, Johns Hopkins University; A. M. Unger, Pullman Standard Car Mfg. Co., Chicago; and M. L. Wood and John Babin, both of Chase Brass & Copper Co.



A. L. MARSH

M. A. GROSSMANN

M. ASIMOW

predictions for any particular alloy have been made and verified. The state of affairs is, therefore, one in which the theory predicts only the general trends of order-disorder transformations in those cases in which they occur but does not distinguish sharply between the detailed behaviors of various transformations. The lack of specific quantitative predictions is due simply to the mathematical complexity of the problem and the difficulty of treating any but the simplest cases. For this reason the principal theoretical work has dealt with idealized alloys in which the forces between the atoms are treated according to a highly simplified scheme. This scheme is known to be very inexact; nevertheless, it contains sufficient truth so that the theories do reproduce the behavior of real order disorder transformations in their most significant respects."

Highlights of the Wire Association's program were the Mordica Memorial Lecture, presented by K. B. Lewis, consulting engineer of Worcester, Mass., and the national defense luncheon on Tuesday. The latter affair heard Dr. Allan A. Stockdale of the National Association of Manufacturers speak on "What Are We Defending?" The association's annual meeting was held on Tuesday afternoon, with J. Kenneth Beeson, president, presiding.

Speaking at one of the meetings of the Wire Association, F. A. Westphal of Sheffield Steel Corp., Kansas City, Mo., said that in the first seven months of this year, at least 40,000,000 man-hours had been lost on strictly defense work and 122,400,000 on non-defense projects. For 10 months of 1941, he estimated work lost at about 200,000,000 man-hours. In the light of these large losses, Mr. Westphal asked if the nation could get its national defense and economic structure for the present tax burdens strengthened on that basis.

The two daily educational lectures sponsored this year by the A.S.M. were unusually well attended. One of the series was devoted to "Hardness and Hardness Measurements," and was delivered by S. R. Williams, of Amherst College. The other series, given by J. B. Austin, United States Steel Corp., covered "Heat Flow in Metals."

HANFORD ECKMAN, Piper Aircraft Corp. (left) receives the $300 first prize in the Summerill aircraft welding contest from J. P. Dods (right) of Summerill Tubing Co., donor of the prizes. Col. G. F. Jenks (center) president of the American Welding Society, looks on. Second prize of $200 was awarded to F. H. Stevenson, Vega Airplane Co., and the third prize of $100 was divided between F. R. Kostoch of North American Aviation, Inc., and C. J. Hertel of Douglas Aircraft Co., Inc.

The equipment exhibits this year were the largest in the history of the congress, with more than 300 firms occupying more than 100,000 sq. ft. of floor space. With priorities dictating where the bulk of the metal working equipment being made today shall be delivered, the general attitude of exhibitors at the show was one of assisting manufacturers to get more work and higher efficiency out of existing machines. An unusually large number of booths featured operating exhibits.

The advent of subcontracting and the corresponding need for observance of strict standards and tolerances, together with the high degree of accuracy required in producing military equipment, have created considerable interest in gage devices and booths exhibiting this equipment were also well occupied.

The influence of subcontracting was also noticeable in the attention directed toward exhibits dealing with the fabrication of magnesium and aluminum. Many plants which previously had no experience with such metals are now being forced to turn to subcontracting of parts of these metals. This, to many plants, has meant to all purposes a matter of "returning to school." Hence the attendants at booths featuring the light metals were kept occupied throughout the show discussing fabricating problems.

The versatility of industry in converting peace time equipment to the production of war goods was forcibly demonstrated at practically every booth where some form or other of a contribution to the defense program was exhibited. These contributions ranged from microscopic bearings for aircraft instruments and stainless mess plates to huge tanks and cannon.

The welding exhibits, most of which featured working displays, ran the gamut from heavy plates to delicate hair like wire. Brazing apparatus also attracted considerable interest. Salvage of broken parts by welding or other methods was also appropriately stressed in a number of displays.

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Metal Show Sidelights

• • • The most popular (or unpopular) topic of conversation at the show this year was priorities. When ever two or more men gathered, the plaints and problems of a priorities dominated industry were inevitably brought up for a rehashing.

• • • OPM men visiting the show suggested that probably within two months the industry will see an important start made in the development of a program of allocations to supplant priorities. The changeover, it was said, will be slow and probably product by product.

• • • A story told by a foundry with an important Army shell order (and one repeated time and time again with variations) — "For the want of a bearing, I can't get a speed reducer; for the want of a speed reducer I can't get a tilting furnace; for the want of a tilting furnace I'm falling behind on my delivery dates."

• • • An all time high in industrial motion pictures was recorded at this year's show, according to an exposition official, who estimated that fully half the exhibits featured motion pictures in some form or other.

• • • As though establishing a motif for the Congress, the nearby Frankford Arsenal laid off 75 workers last week allegedly due to a lack of brass.

• • • Because of shortages and restrictions on supplies of dry cleaning fluids, Detroit Rex Products Co. is reported to have closed its cleaning machine division which formerly supplied equipment to dry cleaners.

• • • Coca-Cola is rated A-1-a, a supplier of enamel baking ovens discovered just about the time he was ready to turn down an order, or put it off as a post-war job. "Essential for Army cantonments and defense plants," the buyer said.

• • • Probably as a result of ordering "from the book" and buying pre-determined quantities of specified equipment for each regiment, the Army has 10,000 saddles in southern warehouses for some mechanized cavalry, according to a National Guard officer.

• • • Chlorinated solvents are among the materials tied up for many diversified civilian uses, and the restrictions are threatening the dry cleaning industry. Proprietors of small clothing cleaning establishments, many of them foreign-born, find it almost impossible to differentiate between various priorities and the documents that must be filled out to get a preference rating. Kolene Corp., Detroit, is one which reports having supplies on hand but undeliverable until the jam is cleared.

• • • With practically every booth at the Show featuring some defense items, one visitor observed that "we could probably lick the Japs with the armament at the show alone."

• • • A manufacturer of conveyor systems for beer and carbonated beverage producers is now manufacturing his conveyors for shell-loading plants.

• • • "The Bull of The Woods," marionette show at U. S. Steel's exhibit played to standees at every session.

• • • One exhibitor who produces metal stampings for use as trademarks in household products is now busier than ever turning out stampings for machine tools and as insignia in Army, Navy, and Air equipment.

• • • It's peculiar how interesting an exhibit can be, a well known engineer told us, when it's explained by a pretty girl, as for instance the Armco bomb proof shelter, and the Lindberg furnaces, to name just two.

Engineers Crowd Daily Defense Meetings

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THE Army has full confidence in the ability of metallurgists in this country to keep one jump ahead of those in other countries in developing new striking weapons and improving the defense qualities of our present equipment, according to Maj. Gen. Jacob L. Devers, in command of Armored Troops, U. S. Army. Speaking at the Oct. 20 session on "General Needs of National Defense" at the Benjamin Franklin Hotel, General Devers also pointed out that "our equipment for war must be better than anyone else's, and not merely just as good as anybody can make." He stated that when changes in tank designs are made, they are gradually worked into the production line and the tank output is not interrupted by changes, such as frequently occur in the production of airplanes. The M-4 medium tank was said to be the best tank that has yet been developed, whereas the giant German and Russian tanks were declared to be failures due to the inability of these vehicles to move over most existing bridges unable to stand the weight, plus the greatness of the target presented to anti-tank guns and artillery. The General told THE IRON AGE that the new amphibian tank recently tested by the Army showed great promise.

General Devers was the first speaker of the four representatives of Federal defense agencies scheduled to explain the "General Needs of National Defense" to the metallurgists, engineers, designers, and other technical men attending the National Metal Show. These morning one-speech meetings were followed by afternoon and evening "National Defense Group Meetings," conducted on the style of "Information Please." The speakers at these forums were seated around several tables before some six or seven microphones, and after their brief extemporaneous talk answered as many questions as the audience was prepared to put to them. The attendance, which approximated 600 per meeting for the morning talks and about 500 for the afternoon and evening sessions, despite several simultaneous forums going on during a number of days and notwithstanding technical and other association meetings scheduled at the same time, was indicative of the high interest in the "defense" groups.

Outlining the growing size and increasing efficiency of the armored force, General Devers stressed the importance of timing in mechanized warfare. He likened tactics to those of a football team, saying, "Opening a hole in the enemy's lines is something like making a hole through left tackle in a football game." Germany had a chance for some "spring practice" in Spain, had a trial "breather" in Poland, and then had its signals clicking perfectly through France, Belgium, and Holland, and later on in Jugoslavia and Greece. However, the Russians were really supplying some stiff competition now.

Reminiscing that in the World War the speed of the tank used then "was about three miles an hour, and they often required overhauling after running four miles," the General pointed out that the present tanks were much swifter and that preventative maintenance to safeguard against mechanical breakdowns had been favorably developed. The Army's "jeep car" was declared to be working out very successfully.

Pointing out that our armored force consists of 5 Armored Divisions, and 15 separate Tank Battalions, the General stated "in the attack against the west front, beginning May 10, 1940, the Germans for the first time in history used an armored army composed of 12 to 14 armored divisions and a similar number of motorized divisions. Some conception of this armored operation may be gained by saying that 46,000 vehicles took part, and the armored army was echeloned to a depth of approximately 125 miles.

"Utilizing supporting fire and terrain to cover the movement of maneuvering elements, armored divisions drive steel columns through enemy defenses to establish supporting points out of which they extend their operations or cover their own advance. The armored columns are usually supported by motorized infantry divisions and combat aviation, and form the spearhead of advance for slower moving field armies. The Germans' operations in Russia illustrate this method of employing an armored force. The battles in the conquered countries have proven the value of the armored divisions.

"Lord Beaverbrook, quoting Russian sources, said that the Germans

had 30,000 tanks and were using 14,000 of these in the assault against the eastern front. These figures are also borne out by our own estimates that Germany is using at least 30 armored divisions, operating on a 100 per cent replacement basis for all active units. Since tanks represent only about 20 per cent of the total motor vehicles in such divisions, we can see that the German armored vehicles being used against the Russians total 28,000. The answer for the German use of so many armored vehicles is to save the lives of German soldiers, since the men in these machines can be killed only by the fire of weapons which penetrate armor, namely anti-tank guns and artillery."

Besides our tank battalions and armored divisions, we have a School, a Replacement Training Center, and an Experimental Board. The Armored Force was declared to be not composed entirely of tanks, such it is "a force of combined arms and includes units of infantry, artillery, air force, engineers, tanks, signal and service troops, such as medical, quartermaster and ordnance units. The Armored Division is the basic large combat formation of the Armored Forces, and its principal attack means is a tank brigade of 400 tanks, although it uses all of the combined arms mentioned to assist the attack."

The impact of defense on steel metallurgy was discussed in the first forum meeting at Convention Hall, on Oct. 20, with the round-table talk bringing out the fact that better coordination of engineers, metallurgists and designers might conserve scarce materials, speed production, and improve defense products. It was pointed out that shortages in nickel, chromium, and vanadium, as contrasted with our current availability of molybdenum and manganese, would probably force our metallurgists to lean more and more on the latter two alloys. Most of the speakers at the "Low Carbon Alloy Steels" session expressed the opinion that the war would be of long duration, so that our use of alloys during the emergency would be based upon economics and availability.

At this meeting, Mr. H. W. McQuaid, assistant chief metallurgist, Republic Steel Corp., contended that "thousands of tons of alloys were being wasted in products which did not need certain alloys, or in component parts of items only some of which needed the alloys." It was generally agreed by the speakers and contributing members of the audience that metallurgists often were asked to prepare materials for certain uses to meet specified tests, although the metallurgists knew that such items would like as not never be subjected in their actual use to the requested test specifications. The suggested solution was that metallurgists and engineers get together more often and battle for their particular ideas on certain problems, along with the designer getting his opinions in, too. In a rather lively open discussion, all present seemed agreed that greater cooperation was necessary to conserve materials, save time, and increase production in our defense program.

Walter Hildorf, chief metallurgical engineer, Timken Steel & Tube Co., pointed out that nickel, nickel-chrome, nickel-chrome-moly, chrome, chrome-moly, and chrome-vanadium steels were scarce, with only manganese and molybdenum available in sufficient quantity for use in alloy steels. Mr. E. T. Barron, manager, Metallurgical Division, Pittsburgh district, Carnegie-Illinois Steel Corp., stated that the best possibility to replace alloy bottlenecks were the carbon-molybdenum - manganese steels, which are now well established. He added that new de-oxidizers show promise but cannot be depended upon fully, while design changes may permit substitutions of analyses not hard to get. Mr. Barron mentioned the possibilities in speedy recovery of chrome-nickel scrap, and praised the ferroalloy producers for their work.

At this meeting, Mr. F. E. McCleary, metallurgical engineer, Chrysler Corp., stated that although economics was the normal basis for our selection of steels, for the duration of emergency we would have to be guided both by availability and economics.

The leader of the meeting was Gordon T. Williams, metallurgist, Deere & Co., while the summarizer was O. W. McMullen, metallurgist, Youngstown Sheet & Tube.

Declaring that "the responsibility of the continued existence of Democracy rests upon the shoulders of the captains of industry as well as upon the armed forces of the United States," Lieutenant Commander J. C. Crommellin, Operations Officer of the U. S. Naval Bureau of Aeronautics, stated that "cooperation and leadership is the remedy to present difficulties in the problem of defense production." The commander said that the theme song of the conquered nations has been "Too Late And Too Little," thereby permitting the Nazi war machine to sweep the European Continent. He went on to say that the fight overseas is also our battle since if Germany wins it will control most of the world's shipbuilding capacity, enabling it to build a gigantic navy and threaten our freedom of the seas.

Commander Crommellin, who has been with the Naval Air Service since his graduation from the U. S. Naval Academy in 1923, and who developed certain dive-bombing techniques, stated that aircraft is just like the "left jab" of a prize fighter with the other forces of the army and navy able to deliver the knockout punch. He said that in July, 1940, our naval force included 1800 planes, and 3000 pilots, whereas the present emergency has necessitated the expansion of these forces to 15,000 planes and 16,000 active pilots in addition to 12,000 reserve pilots. Moreover, in order to keep these planes in the air, approximately 15 mechanics or ground crew workers are required per plane, meaning that the navy's aviation personnel will have to be expanded to 225,000 men to "keep 'em flying."

The commander pointed out on

Stop Strikes, Kill Profit Motive, Craven Advises

"STRIKES of workers that jeopardize national defense and interfere with the production of necessities should be classed and treated as would be mutinies afloat." . . . "Call it what you like—though name-calling gets us nowhere—the military successes of the Axis peoples are due to the sinking of the profit motive for the sake of what they believe to be national survival," Rear Admiral Thomas T. Craven, U. S. Navy (retired), told about 400 metallurgists assembled in the ballroom of the Benjamin Franklin Hotel on Thursday morning, Oct. 23

a large map that the island bases we recently acquired from the British would be of substantial assistance in aiding us to ward off foreign threats to our national security, since they represented our "Front Line" so far as the European conflict was concerned.

During the discussion, the commander quoted a statement of Admiral Tower from the Congressional Record in which the admiral said that deliveries of airplanes to the navy during the first six months of 1941 were 20 per cent below the promised schedule, for such reasons as "delays due to change of design, material shortages, and strikes." The admiral was also quoted as adding that he hoped "Employees and employers would set their country's well-being far above any selfish motive."

At the defense group meeting concerning "Higher Alloy Steels," Mr. C. L. Warwick, consultant to the OPM Conservation Board, Division of Purchasing, revealed that leading steel associations were working with the OPM to establish a list of steel specifications with a minimum number of steels to meet defense requirements. The work being done will also take in the reduction of sizes and shapes of steel to be produced. The Technical Advisory Committee working on this plan includes representatives of the Army, Navy, OPM, industry and consumers, and will cooperate in this work with the British and Canadian Governments. Thus far, a simplification of structural steel shapes has been completed and this list will shortly be released by the OPM. Moreover, the SAE and the AISI are now working to correlate all the automotive steels and a report of the progress thus far is now up for official consideration. Steel groups to be worked upon next will be reinforced bars and barbed wire products, while practically all other groups will be covered eventually.

A feature of the balance of the discussion was another appeal by Harry W. McQuaid, of Republic Steel, for more careful use of alloys by metallurgists and a greater utilization of those analyses which are available at present, containing silicon, manganese and molybdenum. He specifically urged that these elements, along with controlled carbon contents, be used intensively by metallurgists during the present emergency. He also pointed out that change in design and specifications will be needed to conserve scarce alloys, adding that metallurgists will have to learn to double-treat, time-quench, double-quench, and use other metallurgical devices to get around the lack of certain alloy material.

Mr. M. J. R. Morris, chief metallurgical engineer, Republic Steel Corp., pointed out that the metallurgists are ready to tighten their belts so far as available alloys are concerned. He urged greater use of heat-treatment be resorted to in securing certain desirable properties of steel. Other speakers included C. H. Herty, chairman, Iron and Steel Division of the AIME and connected with the Bethlehem Steel Corp.; E. C. Bain, assistant to the vice-president of U. S. Steel Corp.; Walter E. Jominy, research metallurgist, Chrysler Corp.; and H. J. French, manager, Alloy Steel & Iron Development, International Nickel Co., Inc. McQuaid and Bain were both one-time Campbell Memorial lecturers.

During a talk outlining the Navy's position in the national defense picture, Rear Admiral Thomas T. Craven, U. S. Navy, lashed at selfishness and politics as weaknesses in the national defense effort. "It is breath wasted and newsprint squandered to go on fulminating about total defense without the fundamental basis of sacrifice by every individual, every vested interest, and every geographical section of these not-too-well united states," the admiral said. "There has never been a time in the history of this war-wrecked world when patriotism did not involve an element of sacrifice."

Crediting German and Japanese military victories to "coordination," Admiral Craven stated, "No individual interest, no group or sectional interest, no obdurate insistence by organized labor on turning this national emergency to their own advantage in higher wage scales and union prestige, and no equally obdurate insistence by industrialists on profits as

INFORMATION PLEASE: These experts on high strength low alloy steels provided answers to many of the perplexing questions voiced at one of the informal National Defense Forums which featured the Metal Congress this year. The experts shown here, are, left to right: F. B. Foley, Midvale Co.; Jonathan Jones, Bethlehem Steel Co.; A. B. Kinzel, Union Carbide & Carbon Research Laboratories, Inc.; Leon C. Bibber, Carnegie-Illinois Steel Corp.; Col. Glenn F. Jenks, U. S. Army; E. Thum, *Metal Progress*; John Johnston, U. S. Steel Corp.; Paul D. Field, Bethlehem Steel Co.; Merrill A. Scheil, A. O. Smith Corp.; J. J. Kanter, Crane Co.; B. D. Saklatwalla, Alloys Development Corp.

usual, or super-usual—none of these primarily selfish motives has had a look-in with the German or Japanese total defense which functions as total offense." The victories of the axis have been the mutual offerings of whole national communities, a dedication of millions of patriotic citizens, no matter how misguided we believe them to be, to the common welfare through times of searching tests. Call it what you like . . . the military success of the axis peoples has been due to the sinking of the profit motive for the sake of what they believe to be national survival." Rather than branding such thinking as socialism, communism, or fifth columnism, the Admiral suggested that it be named "patriotism."

Speakers at another national defense meeting covering high strength, low alloy steels of weldable grades warned that present figures on availability of various alloys were only tentative and might change at any time due to reasons not now forseen. However it was pointed out that silicon for instance was plentiful and the point was made that although copper was extremely tight the small amount that was needed in making certain low alloy steels would not effect the general copper picture owing to the small amounts needed. In fact, one speaker stressed the point that little was gained by restricting important uses where only a very small amount of alloys were used. Rather, he said, the gains could only be made by restricting the large uses.

Freedom of Seas Vital

The supply of chrome ore is dependent on the freedom of the seas as most of it is imported and if anything occurred to prevent the importation of ores the situation might be viewed as very serious. There was some chance, it was said, to exploit domestic ores but the quantity isn't sufficient to take care of present demands which are growing all the time. As to nickel, little was said except that it was tight and little could be expected for non-defense projects. Manganese was another alloy on which the freedom of the seas depended, a point stressed over and over again. One point brought out was the greater amount of high manganese steel which was being required for shells than at first was anticipated.

Phosphorus is not scarce and it was argued that this element should be used more widely as an alloying material, only it was warned that great care should be taken in making the application.

The same speaker who made reports on the alloy situation also presented a table which showed the lineup of alloys used in high tensile, low alloy steel which were given in the order of their decreasing harmfulness in unit quantities as far as weldability of the metal was concerned.

Describes Harmful Elements

In giving the table of the elements the speaker pointed out that the top and bottom of the list were fairly consistent but the "in between" alloys might be changed in their positions as research continued. Given in order of their relative harmfulness per unit, the elements were as follows: Carbon, phosphorus, sulphur, molybdenum, vanadium, silicon, chromium, manganese, copper and nickel. The appearance of the alloy high in the table does not damn the steel, however, and it was said the entire list was set up relatively. General limits on alloys could not be set on the elements, it was said, except to apply such limits superficially. In fact, the speaker said the best welding limits for various alloys were no limits at all. It was suggested that this was a problem that could best be solved between the steel maker and the engineer designing for the use of the steel.

One speaker urged that too much attention was being focused on the quest for substitutes while the all important question of utilizing present equipment and methods by intelligent planning was getting the "go by." It was stated that in many cases such as construction, car building, etc., high tensile, low alloy steels could be used which would mean a saving in the use of ordinary carbon steels. Any large savings in ordinary steel by use of alloys, and large figures were mentioned, would, of course, mean less ore, less shipping space, less pig iron, savings of coal, coke and all other materials and methods which would be used to make the amount of ordinary steel that would be saved. Specific examples were given in the case of freight cars which are expected to be ordered next year. The speaker said that if all these cars were to be made from alloy steels a saving of 25 per cent in the total steel used could be made. It was argued that the use of alloy steels for freight car construction would mean in many cases that sheets could be used where plates were required when ordinary steels were used. This, it was said, would mean that plate mills would be free to roll more plates for other national defense requirements.

One speaker covering the use of alloy steels in ship hulls stated that as far as possible the use of ordinary steel was specified because there would be little chance of making substitutions once the plan was setup for alloy steels. Alloy steels in ship hulls are only specified where absolutely necessary and once the "specs" are set up there would be little chance of altering them or finding substitutes because of the great changes in operations, etc., that would be necessary. These could not be made it was said because of the urgent need for ships.

Raising the question, "What About Development Work?" Alex Taub, technical consultant to Sidney Hillman, OPM associate director general, told the congress:

"All of us recognize the necessity under the defense program of turning out large quantities of equipment, but when you discover you're playing marbles for keeps, you just can't afford to overlook the development phase of the program and thereby let the other side outsmart you."

Injection-Type Engines Urged

Mr. Taub, an American citizen and former development engineer for Vauxhall, Ltd., in England, called for greater efforts in developing direct fuel injection-type engines, and urged that this country explore to a greater degree the turbo-super-charger, the type whose blades are driven by engine exhaust. It was his view that a lot of work is being done on the mechanical super-charger but that perhaps too little emphasis is being placed on the turbo-type.

He conceded that considerable progress is being made in engine design for combat tanks, but pointed to potentialities for adapting aircraft engines to tanks.

Mr. Taub, who was first appointed to OPM as chief technical consultant to the automotive branch, asked why tanks of American design have to be two feet higher than those of European manufacture.

R. F. MEHL

Structure and

Rate of Formation of Pearlite

Abstract of the Sixteenth Campbell Memorial Lecture

By ROBERT F. MEHL

Director, Metals Research Laboratory, Carnegie Institute of Technology

o o o

IT had been stated by Arnold and McWilliam, and by Benedicks, as early as the year 1905 that pearlite forms by a process of *nucleation* and *growth*. Howe and Levy in 1916 speculated upon how the more rapid formation of pearlite at low temperatures may at least in part be determined by an increase in the rate of nucleation. The work of Davenport and Bain in 1930 on the isothermal reaction curve and the derived S-curve, served to emphasize with great clarity the fact that the formation of pearlite is a process of nucleation and growth of pearlite nodules, and served to establish the basic fact that the critical cooling rate for hardening in simple carbon eutectoid steels is determined by the maximum rate at which this process of nucleation and growth proceeds—the rate of formation of pearlite at the knee of the S-curve.

Accepting the fact that pearlite forms by a process of nucleation and growth, it should be possible to obtain a deeper insight into the operation of the variables affecting the rate of formation of pearlite by studying them in terms of a rate of formation of pearlite nuclei and a rate of growth of these nuclei. Such a study would anayze the isothermal reaction curve into the two factors which determine it, that is, the rate of nucleation and the rate of growth, and such a method of study would therefore be one step beyond that of the isothermal reaction curve and the S-curve.

The data presented here are the result of the labors of a number of graduate students who have been working with the writer on this subject: Messrs. Johnson, Hull, Smith, Pellissier, Hawkes, Roberts, and Colton.

The isothermal reaction curve is determined by a rate of nucleation and a rate of growth. This curve represents the percentage of transformation product formed during isothermal reaction as a function of time. At first the rate of the reaction is slow, then it accelerates, reaching a maximum at about 50 per cent transformation, and then decelerates. The initial period seems long, and it has been suggested that this period is an incubation period during which the matrix is preparing itself to react, but this is an unnecessary conception, for the form of the curve in the intial period is the expected one on the basis that nuclei form with time at a constant rate, and grow with time at a constant rate, as shown by Sachs some years ago.

The course of a reaction by a nucleation and growth process is as follows: The transformation starts by the formation of nuclei, and during the reaction these nuclei continue to form, and of course, to grow. These nuclei are pictured as forming at random in the untransformed matrix; the number which forms per second in a given volume of untransformed matrix is the rate of nucleation. Each nucleus after birth begins to grow; the rate at which its radius increases with time is the rate of growth.

The isothermal reaction proceeds with nuclei forming steadily and each steadily growing, and the nodules will inevitably impinge upon one another. The impingement exerts a retarding effect upon the rate of reaction, and this retardation becomes effective enough to decrease the over-all rate of reaction in the neighborhood of 50 per cent transformation, and from there steadily to decrease it.

Accordingly, the isothermal reaction curve is a result of the combined effects of a *certain rate of nucleation* and a *certain rate of growth*. The curve can be calculated from assumed or measured values of these quantities, and the calculated curve is found to reproduce the experimental curve accurately, as Johnson has shown for the formation of pearlite from austenite. It is an easy matter to

predict how alterations in the two component rates will affect the curve, increasing the over-all rate or decreasing it. And in summary it may therefore be said that there is no uncertainty whatsoever concerning the mechanism of such reactions.

Isothermal Austenitizing

It is to be understood, then, that *pearlite* forms from *austenite* by a process consisting in the nucleation and the growth of pearlite nodules. It was the purpose of this investigation to consider this process, but in order to do so with clarity it is first necessary to make inquiry into the *degrees* of *homogeneity* that can be attained in austenite, for these degrees of homogeneity exercise an effect upon the rate of formation of pearlite.

The formation of *austenite* from *pearlite* likewise proceeds by a process of nucleation and growth, as emphasized by Grossmann in recent years. It should, therefore, provide *isothermal reaction curves* similar to those for the formation of pearlite as first obtained by Bain and Roberts has recently shown that it does.

It will be remembered that isothermal reaction curves at different temperatures for the decomposition of *austenite* to *pearlite* are usually assembled into an "S-curve," which then pictures the rate of reaction over the whole temperature interval.

It should be possible also to assemble isothermal austenitizing reaction curves into an austenitizing S-curve, showing "beginning" and "end" curves for the disappearance of pearlite, a curve for the final solution of carbide, and a curve for the ultimate dissipation of carbon concentration gradients, though the last curve is necessarily schematic for these gradients cannot disappear at a sharp point in time. It may be noted that the disappearance of pearlite is extremely rapid; at 1384 deg. F. fine pearlite, in a previously normalized eutectoid steel, was observed to disappear in 25 sec., and the reaction was too rapid to be observed at 70 deg. F. above Ae_1; but the solution of residual carbides is comparatively a much slower process, as the figure shows, owing presumably to the lower active carbon concentration gradients. (See Fig. 1.)

The isothermal austenitizing curves can be accurately reproduced by inserting the proper values of the *rate of nucleation* and the *rate of growth* into the proper analytical expression, as may be seen in Fig. 1, which shows also the measured rate of nucleation and rate of growth. The interaction of the rate of nucleation and the rate of growth determines the resultant austenitic grain size, and it appears that the factors determining austenite grain size might profitably be inspected from this point of view.

The important variables which determine the rate of austenitizing

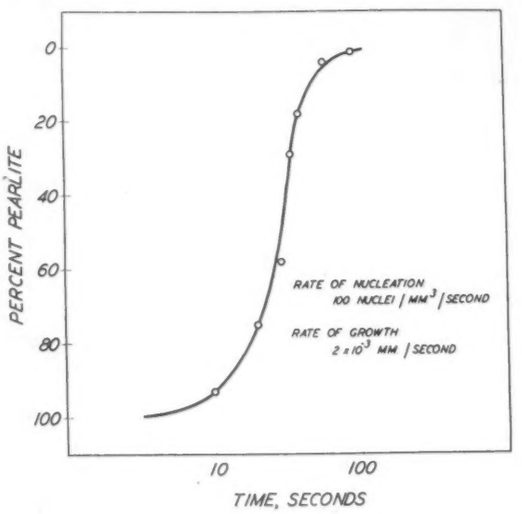


FIG. 1 — An isothermal curve. Points are experimental values. Full curve is curve calculated from rate of nucleation and rate of growth noted on figure.

are different from those which determine the rate of formation of pearlite. Upon austenitizing, two variables appear important: first, the chemical composition of the steel, and second, the interlamellar spacing in pearlitic steels, or the degree of coarseness of the carbide dispersion in spheroidized steels. In the seventh Campbell Lecture in 1932, Bain stated that fine pearlite austenitizes much more rapidly than coarse spheroidized carbide; in 1939 Lauderdale and Harder studied the rate of solution of gross carbides in detail, as had Digges and Jordan in 1935. Many workers have recognized the influence of undissolved carbide and heterogeneous austenite upon hardenability, though there is little quantitative information. (See Fig. 2.)

The importance of the interlamellar spacing on the rate of austenitizing has been demonstrated by Roberts. Fig. 2 gives isotherman austenitizing curves for the fine and coarse-grained steels, prepared from the same heat of steel by Cash, Merrill, and Stephenson, and reported upon by them at the October, 1940, meeting of the A.S.M.

The curves shown in Fig. 2 provide some very interesting information. To repeat, these steels were prepared from a single heat, one part deoxidized with aluminum, furnishing a fine-grained steel, and the other not, furnishing a coarse-grained steel. The curves show the fine-grained steels to austenitize more slowly than the coarse-grained steels, even when the interlamellar spacings of the initial pearlite are identical, as may be seen by comparing the three curves on the right with the three on the left. And it may be seen also that the difference is enough to preponderate over the effect of the interlamellar spacing. Calculation shows that the difference lies wholly in the rate of growth; it may be possible, though it is not certain, that these differences in the rate of growth originate in the effect of the excess alloyed aluminum from the deoxidation upon the rate of growth.

Differences such as these appear frequently among steels of nominally similar composition which are not as yet clearly understood. Similar differences occur also for the final solution of carbide and for the final dissipation of carbon concentration gradients, and these are much in need of definitive study. It is interesting in this connection to note that pure steels austenitize far more rapidly than commercial steels.

Since, then, the rate of austenitizing varies with pearlite spacing, it will be obvious that the rate

depends upon any feature of the prior treatment that affects pearlite spacing. It it well known that a fine-grained steel forms pearlite more rapidly than a coarse-grained steel, and that for this reason the cooling curve will intersect the S-curve at a higher temperature, producing a coarser pearlite at a constant rate of cooling. Accordingly, a normalized, fine-grained steel, possessing a coarser pearlite, will austenitize more slowly than a normalized coarse-grained steel of the same composition, and this is observed. It has also been observed that if the prior treatment is a quench and draw, producing a very fine dispersion of carbide, the rate of austenitizing is markedly greater than that for pearlitic steel and greater than that for a coarsely spheroidized steel.

Rates of nucleation for austenitizing may be obtained for austenitizing curves of the type shown. It is found that there is no detectible difference in this quantity among the several curves, and in this connection it may be observed, that there is more than ample carbide:ferrite interface for nucleation in any of the samples employed; approximation shows that there are 4.10^{11} possible sites for nucleation per cubic millimeter in the coarsest pearlite, which is 10^8 times the number of nuclei that is observed to form. It appears, at least at the present moment, that the rate of growth is the important variable in austenitizing; it will be seen later that in the reverse transformation to pearlite the rate of nucleation is the important variable.

Measurements show that the rate of growth of the austenite nodule remains constant with time; it is interesting that this is true also of the rate of growth of the pearlite nodule. Measurements on the rate of nucleation are not very precise, but rough measurements indicate that it increases with time.

Pearlite from Austenite

Consider now the formation of *pearlite* from *austenite*, as applying to simple carbon steels of eutectoid composition only. It will be understood that pearlite unadulterated by free ferrite or cementite, can form from austenite in hypo or in hyper-eutectoid steels when reacted at low temperatures, but such steels are not being considered; nor are alloy steels. In order to understand the factors which control the rate of formation of pearlite, it will be necessary to understand something concerning the mode of formation and the structure of pearlite.

The Mode of Formation Near Ae_1

It is a common opinion that when pearlite forms from austenite, it first appears at the austenite grain boundaries, outlining them, with the envelope thickening with time until the austenite grains are entirely consumed. Such a mode of transformation may be disignated as "grain-boundary transformation." This opinion has doubtless been formed from the familiar appearance of pearlite in a sample quenched at a velocity slightly less than the critical quenching velocity, or in a gradient-quenched sample, which, to be sure, amounts to the same thing. Since the pearlite in such samples forms at temperatures near that of the knee of the S-curve, this mode of formation is of course characteristic of transformation near the knee, but it is *not* characteristic of transformation at higher temperatures, at temperatures near Ae_1, as Hull has determined.

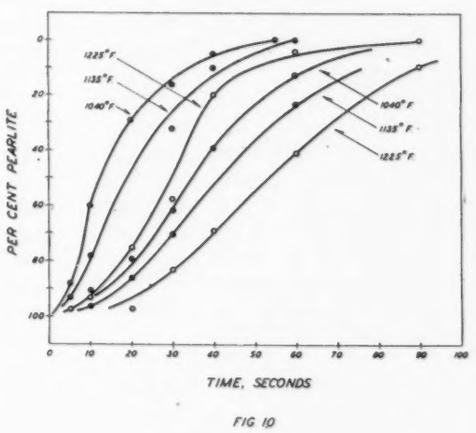


FIG 10

FIG. 2 — Isothermal rate of disappearance of pearlite upon austenitizing at 1350 deg. F. Three curves to left for "coarse grained" steel; three curves to right for "fine grained" steel. Temperatures on curves show temperatures at which initial pearlite has been formed.

At temperatures near Ae_1, pearlite nucleates preferentially at the austenite grain boundary, but the nodules grow *very large*, transgressing grain boundaries, and thus growing into and across grains not yet nucleated, absorbing many austenite grains before impinging upon another growing nodule. Here evidently there are fewer effective nuclei than there are grains of austenite. This mode of formation appears general, for it has been found in all of a number of divers simple carbon eutectoid steels, and in hypo and hyper-eutectoid steels as well; for some reason it has hitherto escaped observation. This large nodule has been named the *"group nodule,"* implying that it consumes a group of austenite grains during its growth, and the mode of transformation may be designated as *"group-nodule transformation."*

The group nodule nucleates preferentially at the austenite grain boundary, as shown by the fact that in partially transformed steels the first visible nodules occur *at the grain boundary*, and by the further fact that the rate of formation of pearlite in the temperature range where group nodules form, varies with grain size. Indeed preferential nucleation at brain boundaries seems invariable in polyphase reaction, and there are excellent theoretical reasons for it. It is not to be implied that nuclei never form within the grain from *homogeneous* austenite, but merely that the rate of nucleation within the grain is *extremely* small compared to the rate of nucleation at the grain boundary.

The growth of a nodule across the grain boundary is doubtless similar to that occurring to a less marked degree at temperatures near the knee of the S-curve; it appears to operate as a chain-nucleation reaction, with the volume increase accompanying the formation of pearlite producing a strain which nucleates pearlite in the austenite grain lying just ahead in the path of growth.

The essential factor in the formation of group nodules appears to be a rate of nucleation very low relative to the rate of growth. With growth across austenite grain boundaries possible, one nodule can grow very large before it im-

pinges upon another growing nodule.

The nodules grow to approximate spheres, and the principles determining the form of the isothermal curve for the formation of group nodules are identical with those already described for the reverse transformation, the formation of austenite from pearlite. And as in that case, the course of the isothermal reaction curve can be readily calculated from an assumed or measured rate of nucleation and rate of growth of spherical nodules, as Johnson and Hull have shown.

Formation Near S-Curve Knee

As is well known, near the knee of the S-curve, pearlite nucleates rapidly at the austenite grain boundary, and in a very short time the grain is outlined and enveloped in fine pearlite. Subsequent transformation consists in growth toward the center.

It has ordinarily been assumed that the pearlite nodule, forming at the austenite grain boundary near the knee of the S-curve, grows only into the grain that gave birth to the original nucleus, and not into contiguous grains. There is good crystallographic support for such an assumption, as Smith has shown, but as in the case of group nodules, trans-boundary growth seems to occur (though to a far less marked degree), for the half-spherical nodules formed in adjoining grains are too frequently juxtaposed, forming full spheres, to have occurred purely by chance. This behavior is again probably to be ascribed to the nucleating effect of the strain generated by the formation of the first nodule.

In each austenite grain numerous small pearlite nodules form. A nodule forms at an austenite grain boundary and starts its growth inward; before it has grown very far, however, another nodule forms close to it, and shortly the two nodules meet; continued growth then consists in the parallel growth of these two typical nodules toward the center of the grain, producing a structure somewhat similar to the columnar structure formed at the ingot wall in the freezing of a pure metal. Here evidently the rate of nucleation is *large* relative to the rate of growth. The average nodule is much smaller than the austenite grain.

The explanation for the difference between the mode of transformation near Ae_1 and that near the knee of the S-curve appears then to be this: at high temperatures the *rate* of *nucleation* is *small* compared to the *rate* of *growth*, and a few large nodules form; at low temperatures the *rate* of *nucleation* is *high* relative to the *rate* of *growth*, and many small nodules appear. In the former case the final nodule in general is *much larger* than the austenite grain, and in the latter *always much smaller*. It is obvious that neither nodule size may be taken as the austenite grain size; Vilella has been quite clear on this point though others have occasionally been confused.

It is obvious from the appearance of a sample reacted near the knee that the rate of nucleation *within* the grain is extremely low, and this appears always to be true of *homogeneous* austenite. It is the low rate of nucleation *within* the grain together with a rate of nucleation at the grain boundary high compared to the rate of growth, that causes the austenite grain boundary to be clearly outlined and developed on partial transformation near the knee, and it is this that enables us to determine the austenite grain size by a gradient quench. But austenite is sometimes not homogeneous, and *heterogeneous* austenite—austenite containing free carbide—frequently provides a high rate of nucleation within the grain, and in this case—a case fairly frequently met as we shall see—it is impossible or at least difficult to determine the austenite grain size by a gradient quench.

The course of the isothermal reaction curve for grain boundary transformation can be readily calculated from an assumed or measured grain size, a rate of nucleation, and a rate of growth, though since the mode of formation is different from that for group nodule transformation obtaining near Ae_1, the form of the calculation is different.

Such calculations are of real value in the study of the decomposition of austenite. If one of the variables, say the rate of nucleation, is unknown, it can be calculated from the other variables and the reaction curve. Some of the data presented later were obtained in this way; they could not have been obtained otherwise. The three variables determining the isothermal reaction curve are, the rate of nucleation *per unit area* of the grain boundary surface, the grain size, that is, the extent of the grain boundary surface, and the rate of growth. If the latter two are held constant and only the grain size varied, the effect of this upon the isothermal reaction curve can be calculated. Grossmann applied the analysis in this way to the reaction precisely at the knee of the S-curve and employing these relative rates was able to predict the effect of grain size alone upon the depth of hardening, and carrying the analysis one step further, was able to predict the effect of grain size upon steels of different hardenabilities. The predicted results are in very close agreement with depths of hardening actually observed.

There is then two extremes in the mode of transformation, the group nodule transformation at high temperatures, near Ae_1, and the grain boundary transformation at low temperatures, near the knee of the S-curve. Between these two extremes graduated intermediate structures, varying in nodule size from one extreme to the other, are observed. The temperature at which the change from one type to another occurs varies somewhat with grain size, and can be calculated as a function of grain size.

Nodular Troostite Controversy

Some attention should be devoted to the nature of pearlite formed at the knee of the S-curve, for as we know it is the rate of formation of pearlite at this point that determines hardenability. It has, of course, been known for some time that the interlamellar spacing in pearlite decreases steadily as the temperature of formation decreases. An extended series of precision measurements of the interlamellar spacing in a number of plain-carbon and alloy steels has been developed by Pellissier, Hawkes, and Johnson. As the reaction temperature is lowered, a product is obtained where the microscope can resolve only part of the nodule, and when the temperature of formation is that of the knee of the S-curve a product is obtained which frequently cannot be resolved in any part. Metallurgists have ordinarily been content to think that those portions which are not resolved by the microscope are nevertheless lamellar pearlite, but of an interlamellar spacing too small for the resolution of the metallurgical microscope. Kourbatoff and Benedicks held this

view in 1905, as have many metallurgists since; yet there have been vigorous dissenters.

If direct evidence is to be provided on this question, some method is needed of observation providing a markedly greater degree of resolution than that characteristic of the best of metallurgical microscopes, and such a method is now available. During the last few years the electron microscope has been developed, which is capable of yielding a degree of resolution for transparent substances up to 100,000 diameters magnification comparable, roughly, to that of the light-optical microscope at 1500-2500 diameters. Herein are shown the first results of the application of the electron microscope to the study of steel, made in conjunction with the studies of pearlite. This work has been done during the last two years, in cooperation with Dr. Zworykin of the Radio Corp. of America and his associates, Drs. Ramberg and Baker.

Metal samples cannot be used directly on the present form of the electron microscope. The technique in its present form consists in preparing a sample by the usual metallographic means and etching it in a manner which gives the best results on viewing under the metallurgical microscope at the highest magnifications, for at the moment it seems that this degree of etching is optimum also for this new purpose; this sample is then coated with a layer of silver 0.1 mm. thick, deposited upon it by evaporation from massive silver; this layer is stripped from the sample, its under surface bearing a minutely accurate contour replica of the surface of the sample. Upon this silver replica is placed an extremely thin layer of collodion and the silver removed from it by solution in acid, yielding then a second replica, now a positive of the original steel surface. This thin second replica is then placed in the electron microscope and photographed.

The transmission electron-photomicrograph of the collodion replica obtained is one in which the high spots on the original sample appear dark, for the collodion replica is thick there, and the low spots light, for the replica is thin at this point. The result is a contour photograph, differing in appearance somewhat from the ordinary photograph, losing some of its advantages, gaining others, and of course gaining greatly in magnification and resolution. With pearlite, cementite appears dark and ferrite light, as they do in ordinary photomicrographs.

Fig. 3 is an electron microscope photomicrograph at a magnification *on the original photomicrograph* of 25,000 diameters of a sample of pearlite formed isothermally at 1180 deg. F.; this pearlite is not entirely resolved by the ordinary microscope, though the electron microscope resolves it wholly. The photomicrograph is typical of the best that have been obtained.

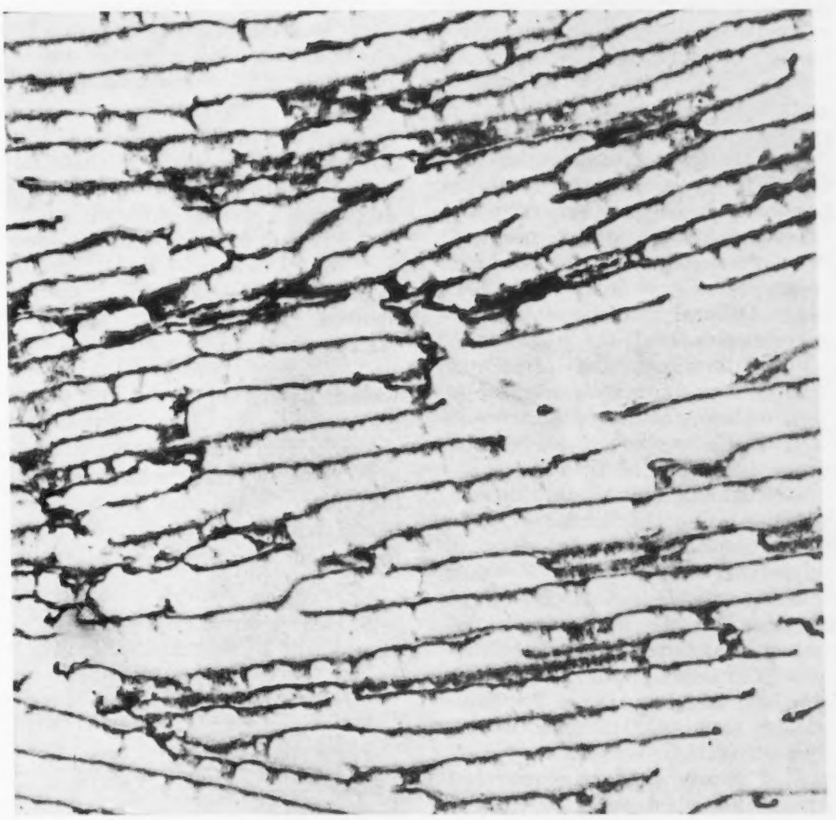


Fig. 3—Coarse pearlite at 25,000 diameters.

At 30,000 diameters, of a pearlite formed at 1075 deg. F., an effect is shown which has frequently been noted in very fine pearlites, an effect which appears to become more pronounced as the temperature of formation is decreased, namely, that the cementite occasionally seems to bridge the lamellae, i.e., ocasionally to cross-connect one cementite layer with the adjacent one.

Some 200 photomicrographs of steel have now been made—they show that there are no areas in a sample composed of what has so frequently been called nodular troostite that cannot be resolved into lamellar pearlite, and accordingly it appears a reasonably safe conclusion that nodular troostite is in fact pearlite of a very small interlamellar spacing.

Therefore, structures are being resolved which the ordinary microscope *cannot* resolve. The question of degrees of resolution inevitably arises, and there is room for controversy. In order to be able to express comparative degrees of resolution, the writer has obtained a selection of the best photomicrographs of nodular troostite taken by others through the years with the ordinary microscope, and measured the minimum spacing which could be resolved; this spacing is approximately 860 Ångstrom units, or 3.4 millionths of an inch. Similar studies on the photomicrographs of pearlitic nodular troostite taken on the electron microscope provides a minimum spacing of 300 Å, or 1.2 millionths of an inch, and it thus appears that a new degree of resolution has been attained. This is not quite the limit for the electron microscope.

Ed. Note:—Dr. Mehl gave many other examples of the application of the electron microscope technique, and then went on to give data on and explain the rate of formation of pearlite from austenite. The complete lecture will be available from the A.S.M. in the near future.

Recent Research Charts

WITH as many as three technical sessions going on simultaneously and a total of 56 papers presented, the American Welding Society reached a new high level of technical achievement, but by the same token made it an impossible task to do more than but highlight a few of the papers on related subjects. A number of research reports presented new concepts that have practical application or confirmed in the laboratory hypotheses heretofore based on observation and experience on the job. Some posed new questions as yet unanswered or suggested new fields of exploration. Others challenged preconceived notions.

Laboratory tests correlating surface finish and contact resistance in spot welding, for example, reported by W. B. Kouwenhoven and J. Tampico, Johns Hopkins University, indicated that at medium current densities smooth surfaces yield higher contact resistance than do rough surfaces, contrary to what would be expected. At high current densities, on the other hand, the contact resistance of smooth surfaces falls to a fraction of that obtained for rough surfaces. The high contact resistance of smooth polished surfaces is due to the presence of poorly conducting surface films of adsorbed gases or oxides. The high local intensities of pressure and current encountered in rough surfaced contacts disrupt these films at very low values of total pressure and current. With smooth surfaces, however, the films are little affected by pressure alone and a high contact resistance exists until the films are disintegrated by a high current density.

If the final temperature at the contact during the welding operation is influenced only by the initial value of the contact resistance, then it might be desirable to use smooth surfaces at the weld interfaces and rough surfaces at the electrode interfaces. On the other hand, the authors conclude, if the heating at the contact is dependent upon the integrated power loss in the contact resistance throughout the entire welding cycle, as seems more probable, the situation is different. It is entirely possible that at the high current densities encountered in practice, the contact resistance of smooth surfaces may drop so rapidly as to contribute very little to the heating. Under such conditions, rough surfaces at the weld interface and smooth surfaces at the electrode interface might be desirable. Only more field experience will tell.

Another popular conception that was upset by research is that friction in the pressure actuating mechanism of spot welding equipment is something to be avoided. Dr. W. F. Hess and L. D. Runkle, Rensselaer Polytechnic Institute, showed rather convincingly that friction, if it can be controlled, may be very useful in making sound welds. Frictional forces, for example, which subtract from the initial electrode force produce an automatic increase in pressure during welding, due to expansion of the metal being welded. To that extent, these forces tend to prevent metal expulsion since the added pressure increases the gasket effect of the cold metal surrounding the molten nugget. On the other hand, frictional forces that add to the initial electrode pressure produce undesirable loss of pressure in the case of metal expulsion, where electrode follow-up is desired.

The authors also pointed out that the introduction of the proper type of friction in a machine results in widening the current range for the production of satisfactory welds, thus making the machine less sensitive to voltage fluctuations.

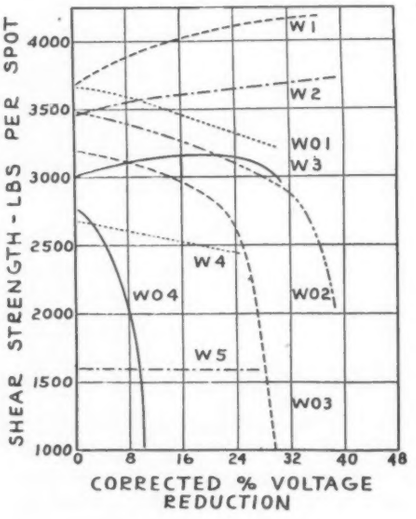


FIG. 1 — Effect of automatic line voltage compensator in spot welding 16-gage Cor-Ten steel. WO curves plot strength of welds without compensator; W curves of strength with compensator show that the device overcompensates at the higher current settings indicated by the higher strength welds.

Line Voltage Compensation

Fluctuations in line voltage is something usually encountered in practice and have a marked effect upon the production of sound spot welds. A. M. Unger, Pullman Standard Car Mfg. Co., Chicago, reported on his experience with the first installation of a spot welding compensator which automatically adjusts the current in line with line voltage changes so that the heat input to the weld remains constant. This compensation is brought about by automatically shifting the phase control of the welding current by electronic tubes. If the line voltage drops, the Ignitron tubes in the automatic timer are made to conduct current for a longer period of time during each half cycle, so that the effective value of the current (r.m.s. value) is brought up to normal. If the line voltage rises, the tubes are made conductive for a smaller portion of each half cycle, bringing the effective value of the current down to normal. Oscillograph records show that the phase shift required to restore the current to its normal value is completed in two to three cycles. Most of the welds made were in the range of 8 to 15 cycles.

Tests made with the compensator show that satisfactory weld strength values can be maintained even with line voltage reductions amounting to 30 per cent or more. Without the compensator, a reduction of voltage of this value would produce unacceptable welds. Fig. 1 indicates that the compensator helps considerably in maintaining

ts Future of Welding

COL. G. F. JENKS

Reelected president of American Welding Society

weld strength consistency at all settings of welding current. Mr. Unger took pains to point out, however, that even an automatic device of this type will not compensate for inadequate section transformers and bus distribution systems, which should be as large as it is economically possible to make them.

Along this same line, H. R. Crago, General Electric Co., advocated that where loads have been increased beyond the capacity of the plant secondary bus system, causing interference between welding machines or increased demand charges, corrective measures at the load should be given consideration and cost comparisons made before any major power supply reinforcement is considered. Two generally accepted methods for improving the demand characteristics of resistance welders are available: the motor generator method in which the single-phase welder load is distributed over three phases of the power system, and the power factor correction method in which capacitors are used. While the motor-generator method has been more widely used in the past lately cost of capacitors have been so reduced as to offer a means for effecting the same degree of improvement at about 35 per cent of the cost of motor-generator sets. In addition, advantages are also offered from the standpoint of stand by losses, upkeep and space requirements, since the capacitors can be hung from the ceiling if need be.

Spot Welding Aluminum

A number of papers dealt with the various methods and equipment available for spot welding aluminum alloys sheets in airframe construction. L. P. Wood, Curtiss-Wright Corp., Columbus, Ohio, for example, surveyed all types of equipment available. The most recently introduced apparatus employs a three-phase process which uses rectified or unidirectional current for the actual welding. Unlike the more widely used stored-energy systems, the welding power comes almost directly from the line and speeds up to 100 welds per min. are possible. However, this method of supplying welding power results in a machine requiring a much larger power supply than stored-energy types. Also, Mr. Wood said, this machine does not compare favorably with stored-energy types in the matter of tip cleaning, one of the most important factors in obtaining high speed production.

In the capacitor type of stored energy system, power is taken from a three-phase shop supply line and is converted into high voltage d.c. by means of controlled rectifier tubes. It is then applied to a capacitor bank where the energy is accumulated over a relatively long period of time compared to the time required to discharge the condensers. After a preset, measured quantity of energy has been accumulated, the capacitor bank is caused to discharge through the primary of a welding transformer as a single unidirectional current impulse magnified many times by the transformer. Variations of machines of this type on the market are in the manner in which the primary transformer current is controlled in order to obtain a desired wave form.

A third type of machine, and the first to be introduced in the aircraft welding field in this country, operates on an electromagnetic principle. In this unit, a rectifier receives three-phase power and converts it into d.c. which is used to charge a transformer or reactor. Upon interruption of the charging current in the primary winding, the electromagnetic energy stored in the transformer is discharged through the secondary which is connected to the welding electrodes. The action is caused by rapid decay of the flux in the core. Since the charging current is broken at maximum current, at first there was trouble in arcing of the contactors, but this has been overcome by increasing their number. A short circuiting contactor also decreases the time necessary for the decay of current. This changes the wave form slightly and permits a faster welding cycle. Provision has also been made for connecting another storage reactor in parallel with the main reactor. These improvements have increased the welding speed to the point where it is compatible with the maximum speed with which a skilled operator can manually handle the average type of aircraft assembly in a spot welder.

In both of the stored-energy systems mentioned above, the author pointed out that higher electrode pressures are possible with higher current values. This is a definite step in the direction of minimizing weld cracks and porosity. Pick-up of metal on welding tips is considerably decreased, thus cutting down the frequency of tip cleaning and permitting higher production. There is also less deformation of the sheet, despite the higher pressures. Welds made with these machines have a great degree of uniformity.

Another paper on spot welding in the aircraft industry was one read by P. H. Merriman, Glenn L. Martin Co., who pointed out that in order to put aluminum spot welding on a production basis, it is necessary that all the variables encountered in the process be automatically maintained so as to eliminate the personal element. The success of the process, he said, depends to a large extent on the caliber of the shop personnel doing the work as well as continuous engineering supervision. At the present time, the Martin company is conducting classes among its spot welding operators to acquaint them with the basic technical details of the process and methods of improving their work.

The most important factor in realizing the maximum possibilities

and production economies of the process, Mr. Merriman continued, lies with the man who designs parts for spot welding. Unless a part is actually designed for spot welding, it may be more economical to rivet it. At Martin, the design engineering group in the engineering department and the spot welding group in tool design work very closely together in the matter of economical spot welding design.

With the thought of a completely spot welded airplane as the ultimate goal, continuous development work is being pursued along the lines which will increase production speed, reduce costs and extend its value into new fields, Mr. Merriman reported. The most outstanding problems, he concluded, are: development of better machines and methods for higher production, continued investigations into fatigue and corrosion resistance, development of superior spot welded joints, development of portable welding machines, and lastly of less expensive equipment.

Speaking of this cost angle, J. W. Dawson, Raytheon Mfg. Co., and B. L. Wise, Federal Machine & Welder Co., pointed out in a joint paper that cost considerations should be on the basis of welded fabrication costs, rather than upon any arbitrary cost of installed welding equipment. On this basis, the most expensive equipment may be the least expensive in terms of its use. The electrical and mechanical functions of the welding equipments have now probably been brought to a higher degree of perfection than the other factors in the aluminum alloy spot welding process. Surface cleaning problems, they admitted, have now been rationalized by recent research findings and welding tip maintenance has been much alleviated by the use of stored-energy type machines.

Inspection of Spot Welds

The subject of weld quality and weld inspection is at present a most controversial issue in aluminum spot welding. Messrs Dawson and Wise suggest that metallurgical perfection is being overemphasized in the absence of sufficiently thorough practical investigations to determine structural adequacy. In this connection, the policy of the materiel division of the Air Corps was outlined by R. E. Bowman, of Wright Field. Referring to Air Corps specification 2011-B, Mr. Bowman indicated that inspection of spot welds is accomplished by the use of tension tests on single spot lap welds and by metallographic and radiographic examinations of representative spot welds. The Air Corps has set up certain minimum strength values for given sheet thicknesses for various materials, including stainless steel as well as aluminum. There are no definite requirements for the equipment, procedure and method of cleaning the sheet, provided the welds made consistently meet the requirements for strength and soundness.

The soundness of the weld may be determined by a microscopic examination of polished and etched specimens of test spot welds. Ductility of spot welds in some cases can be determined by the twist test, in which one end of the specimen is held in a vise and the angle of twist required to produce failure is measured. Results of such a test are plotted in Fig. 2. The U tension test is another one used to compare the ductility of spot welds. The specimen in this test consists of a single spot weld between two metal strips bent to form a U, as shown in Fig. 3. Holes are drilled through the ears of the U pieces and bars slipped into the holes. Tension is then applied through the bars. This test is subject to error due to effects of bending in the specimen and variations in the size of the spot weld, but the test does reveal brittle welds.

The corrosion resistance of spot welds is compared by exposing spot welded panels on racks in tidewater near Miami, Fla., where they are alternately exposed to atmosphere and salt water each tide cycle. The length of exposure is from six months to a year. After exposure, the spot welds are examined visually or tested to determine the loss in strength.

Fatigue tests on spot welded joints have not proved reliable. The most successful procedure has been to conduct static, vibration and service tests on spot welded parts of airplane components. Completely spot welded wings of stainless steel have passed static tests at Wright Field. Aluminum alloy wings in which the skin was spot welded to extruded stiffeners have also been tested statically and given service tests, both of which proved the spot welds satisfactory. Mr. Bowman concluded his paper by saying that the most urgent need at the present time is more data on the performance of spot welds in fatigue, especially for spot welds in the heat-treatable aluminum alloys used in aircraft.

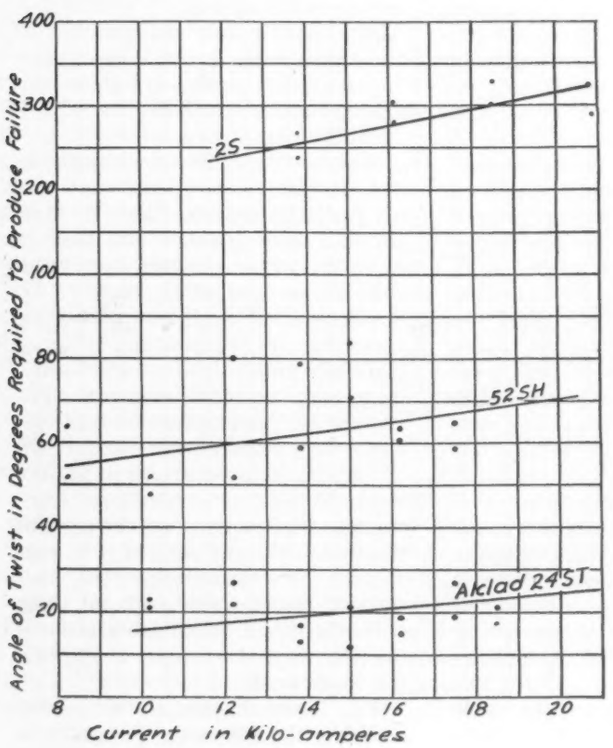


FIG. 2 — Relative ductility of spot welds in aluminum alloys as determined by the twist test specified by the U. S. Army Air Corps. The sheet thickness is 0.032 in. for all three test specimen.

Welding in a Breeze

One interesting line of research reported in the field of arc welding relates to the effect of wind velocity on weld quality, an important factor in structural welding out of doors. J. L. Miller, Firestone Tire

& Rubber Co., and E. L. Koehler, Illinois Institute of Technology, indicated in a joint paper that porosity and the amount of slag entrapped in the weld increased directly with the wind velocity that obtained during welding. Conversely, as the wind velocity increased, the oxidizable elements, manganese and silicon, in the weld metal decreased to less than 50 per cent of the values secured at no wind velocity, but the nitrogen content of the weld metal increased by over 100 per cent as wind velocity increased from 0 to 20 m.p.h. Tension test specimens of all weld metal showed a progressive decrease in per cent elongation with increase in wind velocity, and the impact resistance decreased also, although the yield strengths and the tensile strengths were but slightly affected.

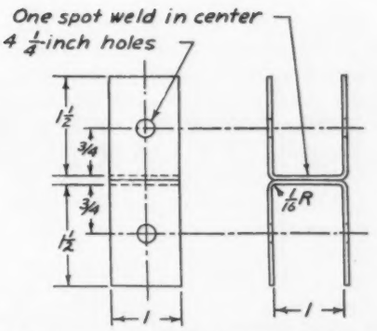
It was concluded by the authors that good quality welding could not be produced when the arc was exposed to a moving air stream having a velocity much in excess of 5 m.p.h. Shielding should be employed if possible and the use of heavily coated electrodes is advocated.

Metal Transfer in the Arc

From the earliest days of arc welding there has been speculation as to what forces cause molten metal to pass from the electrode to the work, but until some recent tests were made by L. J. Larsen, consulting engineer, most of the hypotheses offered had not been checked experimentally. Of all the forces suggested as being responsible for metal transfer, only one—the expansion of gases in the electrode tip—is consistent with observed facts, Mr. Larsen said. This force does account for the reaction against the electrode and the stream of small particles always moving at high velocities from the electrode to the work. This experimental check also explains the inability to weld overhead with pure iron, degasified electrodes. All other factors involved are only of a contributory nature.

Magnetic Arc Blow

A very comprehensive study on the causes and cure of magnetic arc blow was reported by C. H. Jennings and A. B. White, Westinghouse research laboratory. The magnetic forces acting on the welding arc and causing arc blow are a result of the symmetric magnetic field induced by and surrounding



Maximum sheet thickness - 0.065- inch

FIG. 3—U-shaped tension specimen for testing the ductility of a spot weld in aircraft materials.

the path of the welding current. The distortion of this magnetic field, the researchers stated, is caused by three factors, two of which are common to all types of welding current. First, the resultant force on the arc acts toward the best magnetic path or the nearer of two good magnetic paths and is independent of the electrode polarity. Changes in the position of the arc and electrode with respect to the work as the welding progresses; the amount of the weld metal deposited and the degree to which the air gap of the joint is closed, and the presence of metal in the vicinity of the arc heated above the point at which it becomes non-magnetic (about 730 deg. C.) all are causes for changes in the best magnetic path.

Second, the current passing through the work changes in direction as it is conducted away to the ground connection at approximately right angles to the electrode. The current will take the easiest but not always the most direct path. The resultant force is opposite in direction to the current path away from the arc and is independent of the polarity. Lastly, alternating currents induce eddy currents in the work pieces that tend to neutralize and therefore decrease the arc forces produced by the previously mentioned causes. The induced eddy currents cannot occupy the same path as the arc current and are generally not on diametrically opposite sides of the arc; consequently the fields of the arc currents and of the eddy currents are neither concentric nor in line and a repulsive force on the arc is produced. The eddy currents tend to distribute themselves centrally about the non-magnetic region of the heated metal behind the arc. The resultant force on the arc acts in the direction of welding under closed seam conditions.

The greatest force on the arc, Messrs. Jennings and White stated, is caused by the difference in the reluctance of the magnetic path around the arc. The location of the ground is of secondary importance but may have an appreciable effect in reducing the total force on the arc and the latter may be reversed by changing the ground connection only when the reluctance of the magnetic path about the arc is fairly symmetrical. The magnetic forces acting on the arc may also be modified by changing the magnetic paths across the joint with steel strips, starting plates, tack welds, welding sequence, etc. The use of an external field produced by a permanent magnet, an elctromagnet or a combination of both will also be effective. On the other hand, a.c. power has been demonstrated to be a most effective method of reducing arc blow.

Welding Aluminum-Containing Steel

Previous investigations have shown that contained aluminum has a pronounced effect upon the porosity of arc welds in steel. Further studies made at the Battelle Memorial Institute and reported on by C. E. Sims and B. H. Dahle showed that when a mineral coated electrode is used, SAE 1020 steel with aluminum additions up to 0.20 per cent have welding characteristics equal to those of aluminum-free steels. Comparable welds may also be obtained on the aluminum steels when using a cellulose coated electrode, if certain minor precautions are observed. The data indicate that slow welding speeds and low amperage are likely to produce porosity in the deposited metal when using the cellulose coated electrode on aluminum-containing steels. Low amperage appears to be the most important of these two variables and it is suggested that amperages in the middle or high range, suitable for the electrode, be used in welding the aluminum-containing steels.

Incidentally, it is very unlikely that metallic aluminum content of 0.20 per cent will be exceeded or even approached in the ordinary commercial production of steels of this grade. Inasmuch as steels with this high aluminum content can be welded satisfactorily, it is logical to assume that steels having normal amounts should present no special difficulty in the welding operation.

The effect of alumina could not be differentiated from the effect of the metallic aluminum.

The method of filling grooves in multiple pass welding with cellulose coated electrodes is critical when a minimum of porosity is desired. A multiple layer or weaving technique produced excessive porosity in the deposited metal. This porosity can be eliminated or substantially reduced by using a multiple bead technique in filling the scarfed groove.

Economy in Oxygen Cutting

J. J. Crowe, G. M. Deming and J. K. Hamilton, all of Air Reduction Sales Co., reported on an investigation to determine whether more economical oxygen cutting would result from the use of cutting tips fashioned with a divergent exit portion. A systematic analysis of the effect of the various design variables and detail test cuts have led to the development of a tentative series of divergent cutting tips for the range of material thickness up to about 8 in. Using these tips, it is possible to reduce the cutting oxygen consumption 25 to 45 per cent, as compared with standard forms of tips when operating at speeds previously used. It is also possible to operate at speeds 20 to 25 per cent greater than those obtained with standard tips when using the same oxygen discharge rate employed with the standard tips.

These gains result from the narrow high velocity emerging oxygen stream and consequent narrow kerf which is 30 to 50 per cent less than when standard tips are employed. The quality of cuts made with these tips is comparable with that obtained using the most precise of the standard tips.

Gas Cutting of Billets

A review of the various types of machines for the oxy-acetylene cutting of billets for steel forgings was presented by H. E. Rockefeller, Linde Air Products Co. The straightline monitor type machine, while representative of the earlier type of billet-cutting, is extremely practical for cutting forgings and blanks, particularly small blanks and double-lengthed billets used in the upsetter type forging process. Bars are lined up on a bed wide enough to accommodate 40 to 50 widths. The cutting machine travels on a movable bridge-type gantry that spans the width of the bed. By heating the starting point on each bar with a welding blowpipe ahead of the cutting action, the machine can make one continuous cut across an entire row of bars. Production of 100 to 110 blanks per hr. can be maintained from shift to shift when cutting 3 1/16-in. squares.

The portable bar-cutting machine, especially designed for cutting individual rounds or squares, permits the automatic cutting of cold bar stock in sizes ranging from 2 to 15 in. The variations in blowpipe motion for the cutting of rounds or squares are obtained by a simple adjustment of a blowpipe arm linkage mechanism. When cutting a round bar, the linkage is set so that the blowpipe is carried up and over the top of the bar, maintaining a constant height between the nozzle and the work. In cutting a square bar, the blowpipe is swung in an arc, thus producing a quick start and a drop-off cut. A self-contained power unit permits an infinite variation in speed between 1 and 75 in. per min.

The recently developed multi-blowpipe bar cutting machine provides the same advantageous blowpipe motion as the aforementioned portable bar-cutting machine, but is designed as a stationary installation and permits the use of as many as five blowpipes, operating simultaneously. A supplementary preheat for quick starting is furnished. With a suitable conveyor system for bringing bars to the machine, positioning them for the cut, and removing the cut blanks, an extremely high production rate can be obtained.

Oxy-acetylene machines are being used also for nicking shell forging blanks prior to mechanically breaking them for inspection. Recent investigations indicate that such blanks can be severed entirely by oxy-acetylene cutting, since the defects are readily visible on flame-cut surfaces.

Commercial Nitrogen for Neutral Atmosphere Furnaces

IN an attempt to eliminate the numerous defects resulting from heat treating parts at the Stalingrad Tractor Works, Russia, M. P. Braun and A. M. Vlasov decided to use commercial nitrogen obtained as a by-product from a near-by oxygen works. In a paper in *Metallurg*, 1940, No. 2, in Russian, the authors describe their experiments.

The oxygen, 3 to 6 per cent, in the commercial nitrogen was removed by passing the gas through an electrically heated retort containing carbon. The gas was first dried with charcoal or calcium chloride and then passed through the retort, kept at a maximum temperature of 1550 to 1750 deg. F. In the first experiment the retort was filled with charcoal. The exit gases were again dried and passed over heated copper turnings before being admitted into the heat treating furnace.

Plain carbon and low alloy steels were used in the experiments. Changes of weight were recorded and decarburization, if any, was determined by a microscopical examination of sections. The surfaces of the specimens in the first experiments were quite satisfactory after they had been heated for 2 hr. at temperatures between 1300 and 1750 deg. F. All specimens showed losses in weight and were found to have suffered considerable decarburizing.

In the second series of tests, decarburization was prevented by using a mixture of coal and charcoal in the retort. The coal gave rise to methane and hydro-carbons, which effectively prevented decarburizing. The changes in weight of the specimens were negligible and their surface appearance was excellent.

At the Stalingrad Tractor Works, it is intended to convey the nitrogen from the oxygen works through a 6500 ft. pipe line at 90 lb. pressure.

Engineers Probe Light Metal Technology

° ° °

WHILE the theme of the annual fall meeting of the American Institute of Mining and Metallurgical Engineers, held last week at the 23rd National Metal Congress, was one of defense, the papers read and discussions held covered many practical and theoretical developments in the metal industry during the past year, and their applications to current problems faced by production men throughout the country. The meetings covered both ferrous and nonferrous metals, discussing late developments concerning their properties, handling, fabrication, and metallurgical aspects.

Particular interest was evidenced in the technical sessions dealing with magnesium, aluminum and their alloys, an interest growing out of the tremendous demands of the defense program for these metals.

"Relief of Residual Stress in Some Aluminum Alloys," a paper presented by L. W. Kempf and K. R. Van Horn, of Aluminum Research Laboratories, Aluminum Co. of America, dealt with a convenient means of estimating the rates of relief of residual stresses in a series of aluminum alloys. The system worked out by Kempf and Van Horn consists fundamentally of an examination of the relaxation or creep characteristics of the metal. In the examination, a fixture developed by Dr. W. L. Fink during the course of investigations on relaxation and creep was used.

The fixture consists of a means for maintaining a small beam of rectangular cross-section under constant deformation during reheating, and measuring the stress in the beam. Specimens 1/16 x ¼ x 12 in., machined from castings, sheet or tubing, and heat treated and air cooled to room temperature or quenched in boiling water, were placed in the jig illustrated in Fig. 1, and a load was applied by lowering the movable rod in the center of the jig to the desired deformation of the beam and locking it into position. The load was measured by hanging weights on the beam, and, knowing the dimensions of the beam and the distance between the centers of the supports, the maximum fiber stress was calculated from the simple beam formula.

After removing the specimen from the jig, the jig was placed in an electric oven with mechanical convection and heated until the desired temperature was reached. The beam was then quickly reinserted and heated. After heating the beam to the predetermined temperature and for the desired length of time, it was quickly removed from the jig, which was taken from the oven and cooled by fan or air blast. When the jig reached room temperature, the beam was again inserted and the load again measured. This process was repeated until the desired relaxation of the stress had been achieved.

The initial reheating of the beam results in a reduction of from 25 to 50 per cent in the initial residual stress, while extended heating was found necessary to bring about any appreciable further reduction. In general, the higher the temperature of reheating, the greater was the initial reduction in stress and the greater the rate of subsequent relief. The curves that were plotted from the data obtained by this experimental procedure were generally similar to the curves determined on solid cylinders for the same alloy by the stress relief method developed by G. Sachs, of Case School of Applied Sciences. The relief of residual stress involved creep or flow and the curves plotted were similar to those curves for creep or relaxation plotted by Boyd and Davenport.

From the results of the experiments made by Kempf and Van

Horn, curves showing the rate of growth, rate of residual stress relief and variations in hardness with time were plotted. These curves, shown in Fig. 2 are important as indicating the relationship between the rate of hardening in a precipitation hardenable alloy quenched from a high temperature solution treatment and the rate of decrease in residual quenching stress at the same temperature. The reheating temperature of 435 deg. F. is too high to get maximum hardness and the maximum strength which the alloy is capable of attaining at lower aging temperatures. Most heat treatable aluminum alloys achieve maximum combinations of mechanical properties by precipitation at temperatures in the range of 68 to 175 deg. F., but 435 deg. F. is too low to bring about, in a reasonable length of time, complete relief of residual stress induced by quenching. The temperatures necessary for reducing residual stresses to less than 1000 to 2000 lb. per sq. in. in reasonable periods of time would result in inferior mechanical properties because of the rapid overaging occurring at such temperatures. Quenching stresses may be largely avoided by using cooling rates just sufficiently rapid to give the desired mechanical properties. However, some alloys develop maximum resistance to corrosion when drastically quenched from high temperature solution treatments, although slower cooling rates may give best mechanical properties. Resistance to corrosion is usually necessary only where thin sections are concerned. In such sections macroscopic residual stresses are usually low and not troublesome, as in the case of heavy sections where stresses rapidly increase with section thickness.

Residual quenching stresses in aluminum alloys are higher the greater the strength of the alloy. Even, however, with materials that develop the highest tensile strength at room or elevated temperatures, the slowest cooling rate that will produce maximum tensile properties results in residual stresses not higher than about 5000 lb. per sq. in. While these stresses have never been found to cause difficulties in service they may cause distortion during machining of large complicated shapes such as crankcase castings for liquid cooled aircraft engines. In such cases precipitation hardening and stress relief may be combined, heating to temperatures somewhat higher and for shorter periods of time than usually used for precipitation hardening alone.

Another manifestation of the initial rapid reduction of high internal stress on reheating to slightly elevated temperatures is the fact that spring type pistons in internal combustion engines undergo changes during the early stages of operation, which bring about an increase in clearance. Later the pistons will be mechanically stable. The stresses are induced by pressure between the cylinder wall and piston, highest where the pressure is greatest. Heating during initial operation results in relaxation, producing a better fit between the individual piston and the cylinder than could ever be achieved by machining.

Conclusions drawn from the investigations by Kempf and Van Horn were: (1) the Sachs method for following the relief of residual stresses in aluminum alloys on reheating is the most reliable; (2) using this method as a criterion, the relaxation method was devised and used for obtaining a qualitative evaluation of the rate of relief of residual quenching and cold working stresses in a number of aluminum alloys; (3) for complete elimination of stress, reheating to just below the recrystallization range is necessary; (4) important reductions in residual stress may be effected by heating at much lower

FIG. 1—Jig employed to maintain a beam specimen under constant deformation during reheating and measurement of residual stresses of aluminum alloys.

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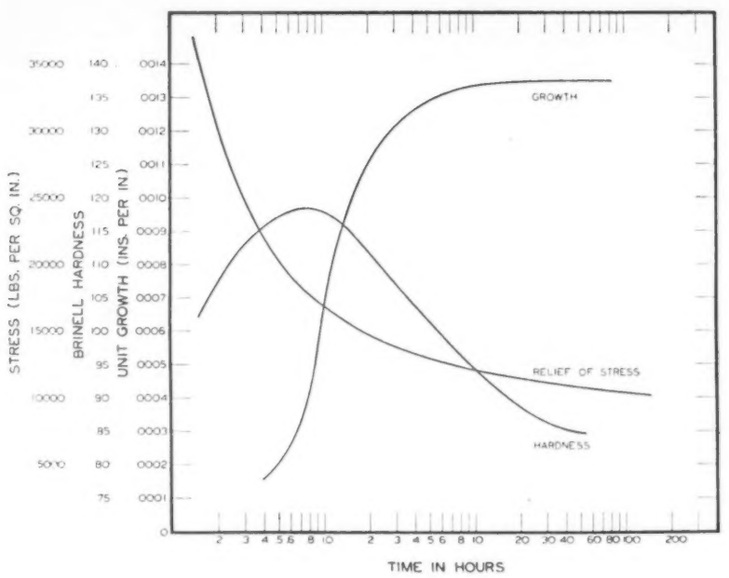
FIG. 2—Curves show the rate of growth, rate of relief of residual stress, and variations in Brinell hardness with time of an Alcoa 122 alloy at 435 deg. F.



temperatures in the precipitation hardening range for most aluminum alloys, and satisfactory combinations of mechanical properties and relative freedom from stress are obtainable by careful selection of reheating conditions; (5) short exposures to relatively high temperatures are more effective than extended exposures to low temperatures for attaining low levels of residual stress; (6) when other considerations permit, as for example resistance to corrosion, the most satisfactory combination of high mechanical properties and low levels of stress can be obtained in heat treatable aluminum alloys by cooling from the solution temperature at the slowest rate consistent with the development of the desired mechanical properties. In most cases this rate will be slow enough to prevent the formation of quenching stresses of a high order of magnitude.

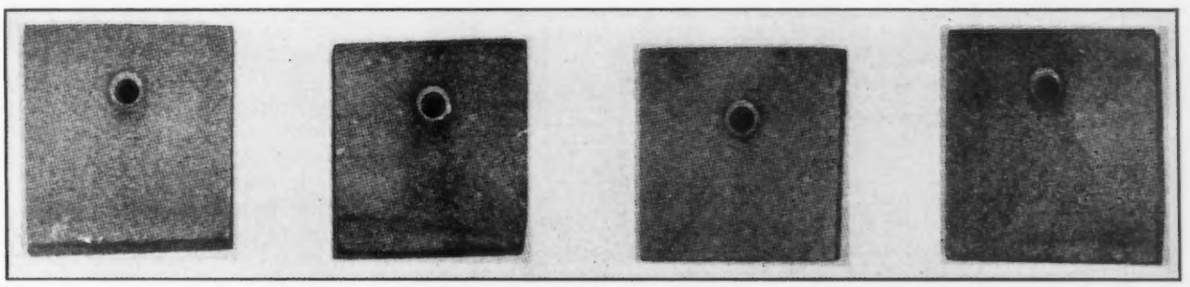


FIG. 3—Unretouched photographs of magnesium alloy specimens after one year alternate immersion in a 3 per cent sodium chloride solution.

Magnesium Corrosion Studied

Another paper of interest and importance to manufacturers and users of magnesium and magnesium alloys was, "Corrosion Studies of Magnesium and Its Alloys," by J. D. Hanawalt, C. E. Nelson, and J. A. Peloubet, of the Dow Chemical Co., Midland, Mich. Magnesium and its alloys have a striking stability against atmospheric attack, being far superior to iron. Specimens exposed unprotected to atmospheric conditions for 10 years showed only a superficial surface film formation. They are also resistant to the attack of salt water even in an unprotected state, giving substantially no weight loss after one year of alternate immersion in 3 per cent salt solution, as shown in Fig. 3. This behavior is often masked, however, because of the extreme sensitivity of these alloys to certain impurities and combinations of impurities.

In extensive investigations, the authors observed that magnesium of commercial purity (99.9 per cent pure) has a corrosion rate in alternate immersion in 3 per cent NaCl solution at room temperature anywhere from 5 to 100 mg. per sq. cm. per day, but the corrosion rate of high purity magnesium is 0.15, ± 0.05 mg. per sq. cm. per day. Further investigations were carried on, and in doing so observations on about 5000 alloy specimens, with more than 50,000 quantitative analyses, were made.

In the investigations high purity magnesium was produced by a special vaporization technique, since it was found that magnesium non uniform in iron content was obtained by simple vaporization. The method used to produce the specimens was by distilling the metal from a magnesium-lead alloy and passing the vapors through a filter. After purification the magnesium was stripped from the condenser and representative samples taken for routine analyses and control corrosion tests. Crystals of this magnesium were found to be only superfically corroded even after exposure for a year or more to the NaCl solution, while the original technical magnesium would entirely corrode away in several days. A typical analysis of the purified magnesium product is:

	per cent		per cent
Fe	0.001	Na	0.002
Ni	0.0001	Mn	0.0005
Al	0.001	Pb	0.01
Ca	0.001	Si	0.001
		Cu	0.0001

In the tests, specimens produced by this special process were subjected to standardized corrosion testing procedure. The sample was cut to a uniform size of ¼ x 1 1½ in. These samples were drilled near one end to accommodate a ⅛-in. glass hook for suspension in salt solutions. Subsequently the samples were ground all over. The standard corrosion test was essentially an alternate immersion-emersion in 3 per cent NaCl solution. The cycle consisted of ½ min. in the solution followed by 2 min. in air, during which time the specimens do not completely dry.

In amounts up to 0.017 per cent, iron was found to have no effect on the corrosion rate of magnesium, but any excess of this quantity caused a marked increase in the corrosion rate. The limit for nickel is less than 0.0005 per cent and for copper it is near 0.1 per cent. Manganese added raises the tolerance limit for nickel, as does zinc additions. The use of 0.2 to 2.0 per cent manganese and of 1.0 to 1.5 per cent zinc appears arbitrary insofar as raising the tolerance limit of the corrosion rate for magnesium, and these choices correspond to analyses of common magnesium alloys. Furthermore, even a very small content of aluminum drops the tolerance limit for iron from 0.017 per cent to a few thousandths per cent, and with 7.0 per cent aluminum, the limit to which iron can be added without effecting the corrosion rate of magnesium is about 0.0005 per cent.

Tolerances Investigated

The authors continued their investigations on the effects of different combinations of additions on the tolerance limits for manganese, iron, aluminum, nickel, copper and other inclusions, showing these tolerance limits both graphically and editorially. Their investigations

showed that the magnesium alloys studied are characterized by tolerance limits for iron, nickel and copper when present singly in the alloys, and that these tolerance limits could be altered to a great extent by additions of aluminum and manganese and by having these impurities simultaneously present. When the latter is the case, there is a lowering of the tolerance limits as determined for the individual elements.

Studies were made when the common impurities silicon and lead were present. It was further found that definite interaction existed for combinations of iron with copper, lead and silicon. When 3 per cent zinc is added to the magnesium-aluminum-manganese alloys, no evidence of interactions of the type found in the iron, copper, lead, and silicon were discovered.

The metallographic examination methods, including a special etching technique designed to positively identify each element, were discussed in the paper. Also, solution potential and hydrogen overvoltage measurements, preparation of these electrochemical samples, measurements of electrode potentials, measurement of hydrogen overvoltages and the electron diffraction patterns of the surfaces of the samples are thoroughly covered.

While for purposes of establishing the fundamental factors governing corrosion behavior of magnesium and its common alloys it is necessary to begin with pure magnesium and to keep every element nil except the ones under observation, this is not necessary for purposes of producing good corrosion resistant magnesium alloys in commercial practice. The high grade ingot magnesium commercially available in United States today can be used as a base for such corrosion resistant alloys by making use of the insolubility of iron, and regarding carefully the selection of materials and exercising adequate precautions in handling.

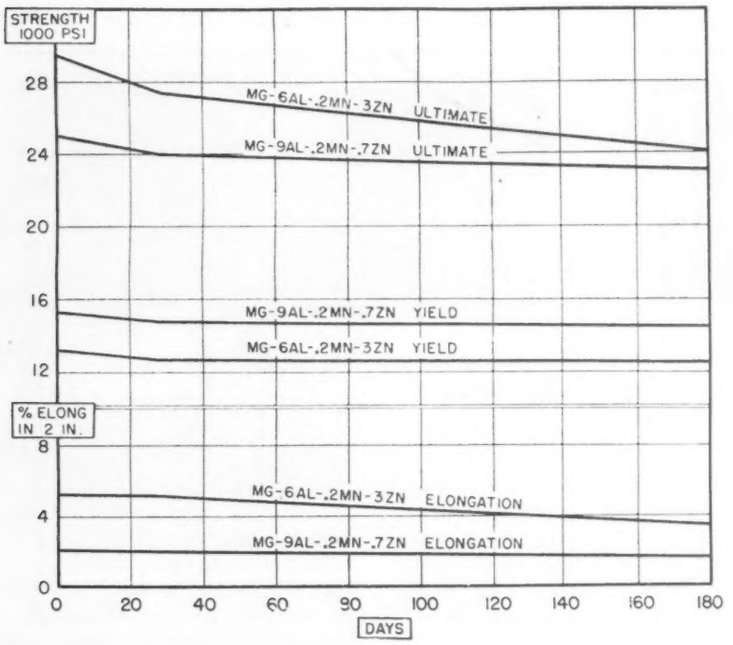


FIG. 4—These curves show the corrosion and tensile properties of cast Mg-Al-Mn-Zn, as developed by Hanawalt, Nelson and Peloubet of Dow Chemical Co.

In commercial practice today the effects of some impurities have been over-emphasized. The data presented show that these impurities may really be present in amounts in excess of the usual specifications without detrimental effect on corrosion stability. For example, the commercial specifications on Mg-6 per cent Al-Mn 3 per cent Zn limit copper to 0.05 per cent, while 0.5 per cent would be allowable as far as corrosion is concerned.

Wrought Forms More Sensitive

Alloys with impurities below the tolerance limits outlined in this paper have been produced on commercial scale in the form of sand castings, die castings, and wrought shapes. The corrosion rates on these alloys are less than 0.2 mg. per sq. cm. per day. Tests of the loss in tensile properties because of corrosion were carried out by the authors on standard test bars of some common Mg-Al-Mn-Zn alloys and are shown in Fig 4. Minor losses occur in cast alloy properties over a period of 180 days in salt solution but alloys in the wrought form are somewhat more sensitive.

Summarizing the results of the investigations, the authors arrived at a number of conclusions, some of which were: (1) the basic nature of magnesium and its important alloys is that they are very resistant to salt water corrosion but are sensitive to certain elements and combinations of elements; (2) there are specific effects on the salt water corrosion resistance of magnesium due to the elements of aluminum, manganese, zinc, iron, nickel, copper, silicon, and lead singly and in all combinations, and these effects have been determined by the studies; (3) the existence of "tolerance limits" or discontinuities in the rate of corrosion as a function of the percentage of certain elements has been demonstrated by these investigations; (4) it is shown in this paper that the elements studied can be classified in their gross effect on the corrosion resistance of magnesium according to the excess of the difference in solution potentials of the magnesium or anodic material and of the cathodic material over the hydrogen overvoltage of the cathodic material; (5) on the basis of metallographic and other examinations, an assumption of a critical concentration of cathodic particles is used to explain the origin of the corrosion discontinuities; (6) alloy compositions that meet the purity requirements for good corrosion stability, and which represent the range of commercial usage, have been prepared on a commercial scale in the form of ingots, sand castings, die castings, and wrought forms; (7) the salt water corrosion resistance of these alloy compositions is from 10 to 100 times greater than that of common magnesium alloys. Strength tests on some high purity casting alloys show negligible loss in properties after six months' alternate immersion in 3 per cent NaCl.

Gear Developments Examined at A.G.M.A. Chicago Meeting

° ° °

STEPS taken to establish new technical standards and the presentation of new mathematical conceptions and test data on gear tooth strength marked the 24th semi-annual meeting of the American Gear Manufacturers Association, held at the Edgewater Beach Hotel, Chicago, Oct. 20-22. A great many commercial problems were discussed, largely relating to problems created by the national defense program and priorities. Warren G. Bailey, Chicago regional office of OPM, also spoke on the subject of priorities at the closing session on Wednesday morning. The formal meeting was opened Monday by W. P. Schmitter, chief engineer, Falk Corp., and president of the A.G.M.A.

Steps were taken at this session to get some new recommended practices started, although none were actually adopted officially. The main object of the several committees sponsoring these projects is to get these tentative practices into use and then whip them into their final form after the "bugs" had been worked out of them in industry. One such, relating to sound-testing methods, was so exploratory in character that it merely outlined in a general way the many factors to be considered in a proposed recommended practice on noise testing—without attempting at this stage to set up any standard of noise levels for specific gear reduction units.

Another standardization project presented in embryonic form related to a proposed basis for a recommended practice for steel gear materials. The whole system, which has been worked out for cast steels and for rolled, drawn or forged steels is based upon a check on the hardness of the gear tooth in the finished state as a measure of the tensile strength of the material, which experimental data shows to be approximately 500 times the Brinell hardness number.

Fine Pitch Gears

A third standardization project has been initiated on fine pitch gears in the range of 30 to 200 diametral pitch. These gears were among the earlier forms to be manufactured (for watches), but though still in use the tooth forms have been largely outmoded and the cutting methods used are obsolete ones in the light of what is being done today in making gears of larger size. Because of the rapid rise in the application of these fine pitch gears in ordnance instruments, particularly in gun fire control apparatus, the A.GM.A. has set up a committee to standardize best accepted practice in this field. The first step taken at this meeting was in the form of a progress report on proposed clearance for fine pitch gears as generated with cutters of rack tooth form, including hobs. Fine pitch gears must have a greater percentage of clearance relative to their depths than those of coarser pitch, first because of the possible presence of dirt and second because wear on the point of the generating tool of rack tooth form, such as a hob, will produce an edge radius in many cases greater than the clearance permitted by generally accepted practice. A table has been prepared showing the practice of one prominent company as regards the working depth and the whole depth of teeth for gears within 30 and 200 d.p., also the addendum and dedendum, circular pitch and circular thickness for such gears.

Calculating Gear Strengths

One of the highlights of the technical sessions was an all-day symposium on gear tooth strength. Allan H. Candee, Gleason Works, lead off with a paper on calculated bending stress in spur gear teeth by reviewing the well known formula developed by Wilfred Lewis in 1892 and then adding a few refinements. The Lewis formula assumed that the tooth load is applied at the tip and the strength of the tooth is calculated as a cantilever beam in flexure, determining the point of maximum bending stress by use of the so-called parabola of constant stress. The conception has been modified today to the assumption that the load is applied on the line of tooth action somewhat below the tip and inscribing the parabola of equal strength in such a manner that it is tangent to the radii of the root fillets.

In addition, Mr. Candee proposed that account be taken of both the compressive and tension loads due to bending and also the compressive stress due to the radial component of the load applied normal to the tooth face. He also showed how the tooth form factor for combined bending and compression

could be computed, but pointed out that the Lewis formula, even in modern dress still failed to take into account the known factor of stress concentration at the small fillet radius, which is mathematically indeterminate but subject to experimental check.

Stress Concentration at Fillets

This experimental check was offered in a paper presented by Messrs. T. J. Dolan and Edward L. Broghamer of the University of Illinois, who reported on the results of a photoelastic study of the stresses in gear tooth fillets. These studies were made by passing polarized light through thin bakelite specimens of gear tooth shape and comparing the light interference bands with known stresses on similar material. These tests showed conclusively that the observed maximum stresses in the compression fillet ranged from 30 to 120 per cent greater than those calculated by the Lewis equation and on the tension fillet side were from 50 to 147 per cent higher than the combined load on the tension side (radial compressive stress subtracted) as mentioned by Mr. Candee.

As would be expected, these photoelastic tests showed that increasing the tooth fillet radius resulted in a pronounced decrease in the stress concentration factor (i.e., the number by which the nominal computed stress must be multiplied to obtain the maximum fillet stress). Changing the pressure angle from 20 to 14½ deg. resulted in an increase from 3 to 10 per cent in the stress concentration factor for the tensile fillet. From the test data the authors developed two empirical formulas for stress concentration factors K, namely:

For 14½ deg. pressure angle,

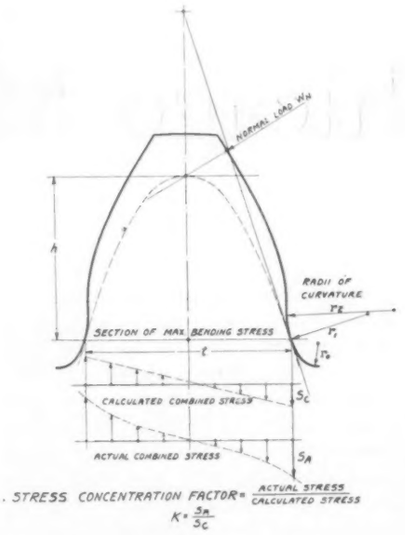
$$K = 0.22 \left(\frac{t}{r_f}\right)^{0.2} \left(\frac{t}{h}\right)^{0.4}$$

For 20 deg. pressure angle,

$$K = 0.18 \left(\frac{t}{r_f}\right)^{0.15} \left(\frac{t}{h}\right)^{0.45}$$

Where t is the thickness at the theoretically weakest section, h the height of load position above this section and r is the minimum radius of the tooth fillet, all in inches.

In a second paper, Mr. Candee outlined a graphical method for determining the position of the point of maximum bending stress and the tooth form factors for bending only and also worked out a more exact geometrical analysis of the same problem. The graphic analysis also showed in detail the exact profile generated at the tooth fillet with a rack type cutter or hob having the cutter point rounded with a known radius. A lively discussion followed this highly technical paper, particularly on the part of M. Maletz, Kearney & Trecker Corp., who worked out a similar analytical approach to the same problem and has produced some simplified formulas.



APPLICATION of the stress concentration factor to the Lewis formula conception of a beam of parabolic section of uniform strength. The actual stress concentration caused by the fillet radius has been determined recently by photoelastic methods.

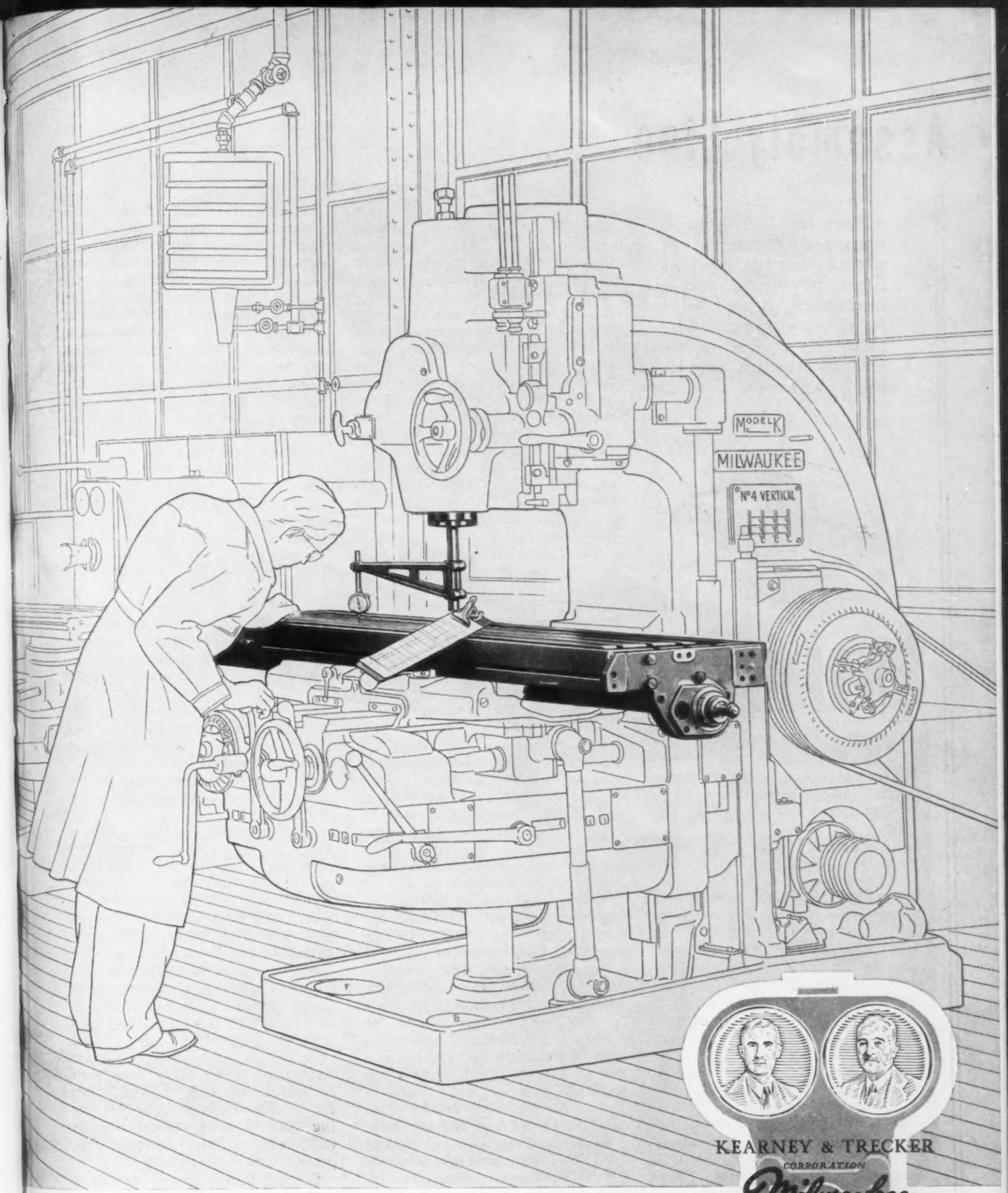
J. O. Almen, General Motors Corp., who wound up the discussion for the day, indicated that calculated stresses are highly misleading, that photoelastic and strain gage methods do not tell the whole story, but that the chief reliance should be placed on fatigue life tests of machine components, like gears, provided however, that laboratory data are correlated with service reports of field failures. He warned his audience, on the other hand, to expect a wide dispersion in lives of such components under test, indicating that the scatter of life tests is such that the results of tests on even a dozen specimens is most inconclusive. One or two hundred tests are often called for.

On the other hand, the speaker went on, results obtained on laboratory fatigue test specimens do not correlate very well with fatigue lives obtained from service data or from tests on machine components. The reason is that the test specimen is very carefully prepared to avoid all surface imperfections, abrupt section changes, internal stresses, etc., whereas machine parts have all these points of weakness. Permissible stress at the fatigue limit of a machine part may be less than 10 per cent of the ultimate strength of a material, whereas laboratory test specimens may indicate 50 per cent or more as obtainable.

Published fatigue curves, Mr. Allen said, are based on an insufficient number of test specimens. When plotted on an S-N diagram (Stress vs. cycles of stress application) there is a wide scatter of test points due to unavoidable differences in test specimens, no matter how carefully they are made. In general, however, when plotted on log log coordinates, the envelope of the life test data is in the form of a cone whose apex approaches the ultimate strength of the material at a low number of cycles. At low stress, the width of scatter of test results in terms of life may be several hundred per cent, and unless a considerable number of tests are run for each part, there is no assurance that whatever life difference is found is real or just the chance location of those particular test points within the scatter band.

The author also pointed out that the stress range to which a machine component is subject has a marked effect upon its fatigue life, indicating that specimens subject to a low stress range have a much longer life than those subject to a wide stress range. Mr. Almen offered a hypothetical three-dimensional diagram to represent qualitatively the effect of stress range on life as well as stress intensity.

A review of E-P lubricants in industrial use, presented by H. A. McConville, General Electric Co., indicated that though there are about 10 varieties of such extreme pressure lubricants available, there is only one type found in general use for industrial gearing, like steel mill drives, namely a mild E-P lubricant made up of mineral oil plus lead naphthenate or oleate compounds (lead soap). Powerful E-P lubricants like those containing active sulphur are felt to be too corrosive on the gearing, although some chemical action is desired in order to condition the surfaces to carry the heavier loads.



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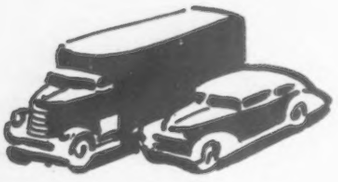

DETROIT—On top of the big aviation manufacturing program in which the country is now engaged, there may soon be imposed a demand for 10,000 twin-engine cargo and transport planes for use in the United States and on new projected South American airlines.

This plan is one of three which have been aired recently in automotive and aviation trade circles. It appears, however, to be on the verge of realization. Its import is indicated by the fact that it represents more than 20 times the number of airplanes now serving domestic air transport requirements. Directly or indirectly, names of prominent businessmen and engineers in Detroit are being linked to the plan.

Proposed designs call for materials and production methods which are of direct interest to Detroit auto plants. In addition, the post-war aspects of these air transport proposals indicate one of the means by which the auto plants might be able to remain in the airplane manufacturing business after the heavy military contracts are filled by them.

The proposal for 10,000 planes is surrounded by secrecy, but fonts of wisdom say that Jesse Jones of the RFC and William B. Stout, Detroit engineer, are at present guiding this program toward ultimate realization. A committee which includes these and two other leaders of the aviation industry, plus an RFC representative, is working actively on the program now. The immediate intention appears to be the building of 1000 of these cargo planes, probably for use in South America to speed up communication and transportation with neighboring countries and offset the air-hold which the Nazis have gained there. Another 9000 planes are talked of for use as Army transports for handling military freight and, if necessary, for the transport of troops and equipment for hemisphere defense.

The planes probably would be a slow landing type, able to get in and out of small airports, would have a wing span of more than 100 ft. and be provided with ample space in the fuselage for carrying bulky freight.

THE second plan is one known to have the interest of the Fisher brothers of Detroit, founders of the Fisher Body Co. Their enthusiasm is pinned on the idea of huge, all-metal cargo freighters with detachable wings and power plants which could be removed to permit the cargo-carrying fuselage to be driven along roadways by a self-contained power plant and automotive-type driving wheels. The idea somewhat resembles the use of trailers and semi-trailers like those built by Freuhauf in Detroit for highway transport of freight. In fact, it is patterned after the automotive trailer. The argument is that air freight and express would be cheaper and quicker if shipments could be loaded in the fuselage at a manufacturer's plant, driven directly to the airport, flown to destination and then driven again on roads to the final delivery dock.

At present, it does not appear that the Fisher program is likely to be immediately realized although there is a lot of talk and gossip about it. There doesn't seem to be any connection with the Jesse Jones-RFC plan except that the purposes are similar.

The third suggestion is one advanced by Col. Edward S. Evans, president of Evans Products Co., Detroit, and father of the glider movement in the United States. Certainly not an impractical visionary, as attested by his background as a transportation expert in the railroad and automotive industry, and a pioneer in air transportation, aviation training and the manufacture of airplanes and dirigibles, Evans is advocating with renewed vigor a system of freight hauling by towed gliders. On long, cross-country hauls the towing airplanes would detach units from its train at cities along the route. Auxiliary pilots in the glider would then fly the freight load to its airport destination. Proposing gliders with load capacity of two to five tons. Evans foresees the possibilities of freight gliders carrying up to 10 tons cargo.

WHILE transport airplanes cost $40,000 to $100,000, the towed units could be manufactured for $3500 to $10,000. depending upon size, he indicated to THE IRON AGE. The proposal for the towed glider freighters is based upon the fact that the towing plane can carry many times its own weight in this manner with only a moderate slowing of its top speed and an increase in the length of field needed for take-off.

Gliding, which has been solely a sport in the United States until now, has been employed by the Russians and Germans in military troop movements in mock war for more than 10 years. The use of gliders was, of course, widely publicized in the German invasion of Crete but, acording to experts, was not as successful as newspaper stories indicated. However, largely as a result of this, the Army and Navy have undertaken experimental programs in recent months. Since last spring Army pilots have been trained at Elmira, N. Y., and Joliet, Ill., in groups of 24. A new training base is being established in California to continue this program.

Boomed into business, at least a half dozen small manufacturing plants have been established to build these craft. With a $100,000 appropriation made by Congress this summer, the Navy is buying 14 gliders, four of them of the troop-carrying variety. Two will be 24-passenger troop carriers, two

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Perhaps our facilities can help you maintain the pace by putting worn gages or parts back into the running. We will be glad to cooperate.

These gages all were worn out and then quickly restored "better than new" by hard chromium plating and refinishing to size.

PRATT & WHITNEY

Division Niles-Bement-Pond Company · West Hartford, Connecticut, U. S. A.

will be 12-passenger troop carriers, and 10 will be 2-place training planes. The 24-seat gliders, it is reported, will be built by Snead & Co., Orange, Va., and the 12-seat gliders will be built by Allied Aviation Corp., Baltimore. For the Army and the Navy, two-seat all-metal gliders are being manufactured by Schweizer Glider Corp., Elmira, N. Y. In addition, the Army has placed an order with the Frankfort Sailplane Co., Joliet, Ill. The latter is erecting a $65,000 manufacturing plant near Chicago.

GLIDERS being built by the Navy are to be used principally by the Marine Corps for experiments. In this, the Navy and marines are pointing the way to the possibility of cargo gliders of the type suggested by Evans. The 24-seat gliders will have 110 ft. wing spans and gross weight of 12,000 lb. The pay-load is understood to aproximate 63 per cent of the weight. The 12-seat gliders will have 88-ft. wings and gross weight of 6,500 lb. Both of these valuable freight and express.

These three plans for cargo-hauling air transport, while not directly related, display a uniformity of purpose that is interesting. Certainly it is difficult to doubt that, when the war is over, commercial air transport can stand still for very long. The impetus gained during the war period will speed the realization of air transport for all first class mail and all valuable freight and express:

The three plans are all alike in that their proponents are worrying about where they can get materials. Aluminum and magnesium supplies are nearly 100 per cent earmarked for the bomber program, with even fighter planes and other types of military planes likely to get only the "leavings," if any. If these transport planes are produced, they too, will have to make use of alternate materials. Under consideration at present is a great variety of possible substitutes including the old-time wood and fabric used in airplane construction, steel tubing with fabric covering, stainless steel, other non-stainless varieties of steel, and plywood. Plastics in conjunction with plywood might have some place in such a program and so might the new non-metallic substitute for aluminum introduced recently by U. S. Rubber Co. under the name C-102 (see announcement of this material in THE IRON AGE, Oct. 16, 1941, page 54.).

A POSSIBILITY of a return to the old method of construction with wood and fabric for major parts of the airplane is not to be taken too seriously because of the great variety of other more suitable materials which can be suggested. Principal of these, of course, is stainless. Experience with using stainless steel for airplanes is relatively limited, with Budd Mfg. Co., and Stout Engineering Laboratories, Inc., having the main background of information. So far, stainless sheet has proved to be more weldable than aluminum sheets, although somewhat more difficult to work and form into desired shapes.

The question of getting sufficient quantities of stainless sheet is also raised, but at least three major steel companies have put up convincing arguments to substantiate assertions that the necessary quantities could be produced. Tonnages of 500 per month, and 1000 tons per month after the first of the year, are mentioned.

Plywood planes were produced in large numbers a few years ago and have a history which indicates that this material is satisfactory and is available in quantities to fit the program. Plastic impregnated wood and plywood are materials now going through extensive development tests. They have been widely publicized but weight is reported to be greater for this type of material than for plain plywood, and fabrication is more difficult at the present stage of development.

C-102 is a relatively untested material but has some possibilities for use even in structural parts. It has already been suggested to replace panels in bus and truck body construction but was designed to be used for bullet-proof gasoline tanks. The substance is fibrous and rubber-like and its ingredients are organic materials, non-strategic in nature. Production facilities do not exist yet but are being planned.

The material situation is so pressing in the aircraft industry that, as reported in this column last May, the aviation industry is making every effort to find suitable alternate materials. Attempts to use molybdenum alloy sheet steel and ordinary black sheet steel, reported here also last spring, have shown great promise. It is probable that these materials will be adopted for many non-structural parts which heretofore have been made of aluminum alloy. As a matter of fact, there may be some announcement shortly of the adaptation of low-carbon sheet steel for several important parts of one type of airplane.

THE search for materials has also resulted in the development of some important plastic parts. Stinson, a division of Vultee, operating at Wayne, Mich., is making tail cones and wheel strut fairings of plastics for private-owner airplanes.

Purchasing agents, who collectively certainly are in a position to keep a record of the pulse of industry, report increased signs of general business flattening out. In this area, members of the Purchasing Agents Association have indicated in reports that 16 per cent of them gaged September business at a lower general level than August business. The defense program is gradually crowding non-defense manufacturing into the background, they say. Reports to the Association also show that commodity prices are steadily advancing all along the line, in spite of price ceilings and SPAB regulations. Eighty-four per cent of the buyers in the Detroit area confirm this trend. Their reports also indicate that inventories have about reached their peak but are sadly out of balance in many cases because hard-to-secure items are becoming depleted although the not-so-hard-to-get items are piling up. This condition is also indicated in the buying trend chart published here a week ago, which showed a shift to more extended buying on many items.

Automobile production in the last week totaled 91,855 passenger cars and trucks in the United States and Canada, compared with 85,600 in the previous week and 117,080 in the corresponding week of 1940.

G.M. Gets $8 Million Award

• • • **The War Department** announced last week the award of a contract for propeller assemblies to General Motors Corp., aeroproducts division, Dayton, Ohio, totaling $8,099,595.

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Better tooling—with the aid of Matched Tool Steels—is saving precious minutes—hours—even days.

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Washington . . .

• Eighty-five per cent operations this year forecast due to scrap shortage . . . Scarcity greatly increases burden on blast furnace bessemer capacity . . . Tighter squeeze coming in civilian supplies.

WASHINGTON—Shortage of scrap has become so acute that already steel production has taken a downward trend and in some quarters predictions are being made that ingot output will drop to 85 per cent of capacity by the end of the current year. Supplies of old materials are generally low. In some instances bottom is being scraped. In others operations have been curtailed and are almost on a day-to-day basis. Adding to the seriousness of the situation are reports coming to defense officials that some of the scrap being gathered in the augmented collection campaign is of such poor quality that it requires extra treatment with a resultant loss in highly important steel tonnage.

This is said to apply particularly to alloy steel. Unable to get first grade scrap, it is necessary to resort to poorer grades that have to be first melted in the open hearth furnace before being poured into the electric furnace—a duplexing process that would be avoided if the high grade scrap were available. The oncoming severe weather will add to the difficulties since it will slow up scrap collection.

This situation naturally increases the burden on the blast furnace and Bessemer capacity, the former to supply pig iron and the latter to provide synthetic scrap made from pig iron. Beyond that it means a heavier drain on coke and ore supplies which also have become a matter of concern. As if these complications are not enough, so-called organized labor leaders, while giving pious promises of cooperation in the defense effort, take advantage of the emergency and unhesitatingly pull strikes to enforce outrageous demands knowing that a politically meek Administration will do nothing about it aside from vociferating, if it does that much. The lambasting and preaching to speed up production are reserved for industry, hobbled though it may be by conditions it cannot control.

THE Hauck steel expansion report gave considerable emphasis to the raw material situation in recommending a 10,000,000-ton increase in steelmaking capacity. It proposes the only intelligent and practical plan conceivable to solve as far as possible the problem of a scrap scarcity short of a further drastic curtailment of civilian steel supplies. This latter action, highly disturbing as it will be on consuming industries, labor and communities, is distinctly in the picture. But even here there are defense officials who claim that already 85 per cent of the steel output is for direct defense needs and "essential indirect defense requirements." This point is made in meeting the contention that only 25 per cent of the steel production is for the armament program, including lend-lease requirements.

Thus they leave a leeway of only 15 per cent as being purely civilian steel that could be drawn on further for the defense needs and that would be a most harsh, devastating step. Too, if further curtailment of civilian steel, including so-called "essential indirect requirements" is not resorted to, together with a more rigid clamping down on inventories, it is not seen how the lack of scrap can be overcome.

THE plan is to build 15 new blast furnaces, requiring 18 months or more, to supply about 6,500,000 tons of pig iron and to build up an additional Bessemer capacity of 1,000,000 tons to make synthetic scrap, this capacity itself being fed from the blast furnace and also calling for a long period for construction. Even these new productive units, it is claimed in trade circles, will just about be sufficient to keep operations at their present rate. This would mean no actual steel expansion.

Meantime until this pig iron and Bessemer capacity comes into production it is predicted that the shortage of scrap inevitably will mean a lag in steel production, a condition that already has set in. And since the concentrated demands for defense material jam the steel industry, the belief grows that there will be a much tighter squeeze on civilian supplies, call it essential or non-essential, until this hump is leveled out. When that will be no one knows.

Defense officials, however, do not agree that there is going to be such a sharp drop or such a wide gap in production as some in the trade predict on the basis of scrap shortage. But the move definitely means that production of pig iron and its product—synthetic scrap—is to be greatly increased and used in much larger ratio in the open hearth charge to make up for the scrap shortage. This will be an interesting trade evolution to watch as it will bear on peace time practice.

Self-contained units making their own pig iron and mixing it with what purchased and home scrap that is available will naturally have more assurance of supplies of raw materials than will the non-integrated producers who have to purchase both their pig iron and scrap but it is assumed that during the emergency priorities will be depended upon to take care of their problem. Generally, the open hearth mix consists of 50 per cent pig iron and 25 per cent each of purchased and home scrap.

IN the steel expansion program, however, not only is there a much greater use of pig iron contemplated, but it is intended that the proposed new plants of the Columbia Steel Co., and the Bethlehem Steel Co. on the Pacific Coast use only pig iron and home scrap, and no purchased scrap, for the suggested 1,865,000-ton increase in ingot capacity. To provide more ore for the expanded blast furnace program SPAB has approved Mr. Hauck's recommendation for the construction of 25 additional Lake ore boats. Contracts for 16 such boats have been awarded by the Maritime Commission, but delivery will not begin until April, 1943, so

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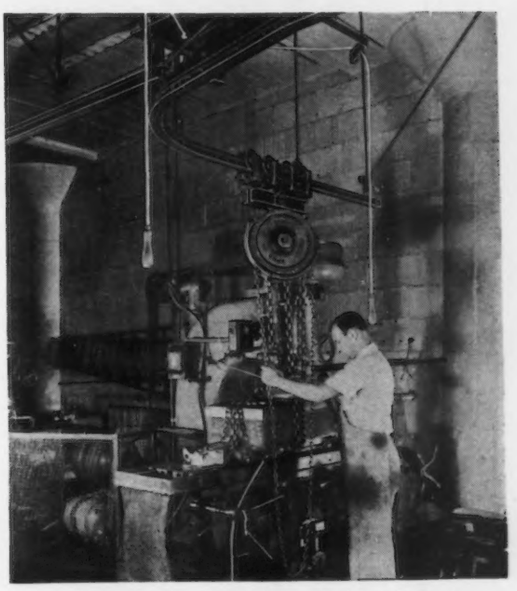
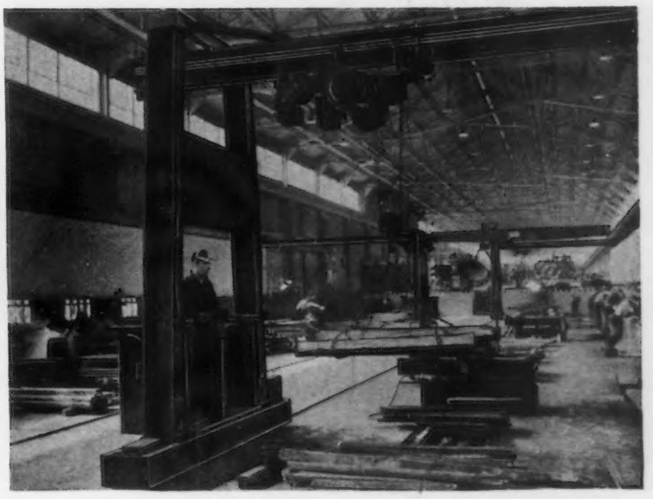


Spur track over milling machine helps operator set heavy die block.



Power operated gantry feeds billets to cleaners at snagging wheels.

The American MonoRail Co.

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that they are not any part of a solution to the scrap shortage problem until that time. The 16 boats will have a season carrying capacity of about 5,600,000 gross tons of ore equivalent to approximately 3,200,000 tons of pig iron for furnaces served with Lake ore. A record shipment of 72,000,000 tons of Lake ore is expected during the 1941 season, exceeding by 5,000,000 tons the previous record of 67,000,000 tons in 1916.

Japanese Collect Fences, Gutters, in Drive for Scrap

Washington

• • • **Cessation of trade** with other countries has aggravated the raw material shortage in Japan, disrupting industrial activities and all business transactions, the Department of Commerce reports. Collections are being made of railway cars, post, wire, name plates, kitchen utensils, roofing plates, gutters and pipes and manhole lids. Fences around government and business buildings have disappeared. Salvage companies are raising sunken ships for scrap.

OPM Approves Die Casting Committee

Washington

• • • **OPM has given its** approval to an industry advisory committee for the die casting industry. Committee members include:

G. M. Rollason, manager, Die Casting Division, Aluminum Co. of America, Garwood, N. J.; Charles Pack, president, Doehler Die Casting Co., Toledo; R. C. McCague, president, Kiowa Corp., Marshalltown, Iowa; Norman A. Parker, president, Parker White Metal and Machine Co., Erie, Pa.; George L. Meyer, Jr., general manager, Stewart Die Casting Division, Stewart-Warner Corp., Chicago; Carl Heussner, Metallurgical Engineer, Chrysler Corp., Detroit; D. Basch, metallurgical engineer, General Electric Co., Schenectady.

A. E. Mervine, assistant general manager, New Jersey Zinc Co., New York; C. M. Sorenson, president, Continental Die Casting Corp., Detroit; H. L. Harvill, president, Harvill Aircraft Die Casting Corp., Los Angeles; Thomas E. Coleman, president, Madison-Kipp Corp., Madison, Wis.; Arthur G. Chase, vice-president, Precision Castings Co., Inc., Syracuse, N. Y.; H. H. Weiss, president, Superior Die Casting Co., Cleveland; J. R. Townsend, material engineer, Bell Laboratories, Inc., Western Electric Co., New York; W. A. Singer, president, Apex Smelting Co., Chicago; Irwin Cornell, vice-president, St. Joseph Lead Co., New York; and Ernest Scheller, director of research, Reynolds Metals Co., Louisville.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

14 More Plants Awarded Navy's "E"

Washington

• • • **Fourteen privately-owned** plants and seven naval stations last week were given the Navy's "E" symbol of excellence at a special ceremony, augmenting the list of 25 manufacturers of ordnance equipment previously honored.

Companies receiving the award last week included: Bridgeport Brass Co., Bridgeport, Conn.; Triumph Explosives, Inc., Elkton, Md.; Ingersoll Milling Machine Co., Rockford, Ill.; Monarch Machine Tool Co., Sidney, Ohio; American Locomotive Co., Schenectady; Crucible Steel Co. of America, Harrison, N. J.; Goss Printing Press Co., Chicago; Continental Gin Co., Birmingham, Ala.; Vickers, Inc., Detroit; Heppenstall Co., Pittsburgh; National Forge & Ordnance Co., Irvine, Pa.; Bethlehem Steel Co., Bethlehem, Pa.; SKF Ball Bearing Co., Philadelphia; and Carnegie-Illinois Steel Co., Homestead, Pa.

Naval establishments added to the list included the Naval Gun Factory, Washington; Naval Torpedo Station, Newport, R. I.; Naval Ammunition Depot, Mare Island, Cal.; Naval Powder Factory, Indian Head, Md.; Naval Ammunition Depot, St. Juliens Creek, Va.; Naval Ordnance Plant, Baldwin, L. I.; Naval Torpedo Station, Alexandria, Va.

Under the plan for rewarding firms and employees for their work on navy ordnance orders, companies so honored are entitled to fly the Bureau of Ordnance flag, the Navy "E" pennant, and employees are given lapel buttons.

Canadian Iron and Steel Figures Show Expansion

Washington

• • • **The Canadian output of** pig iron in the first eight months of 1941 totaled 833,351 gross tons, compared with 734,436 and 422,028 tons in the corresponding periods of 1940 and 1939, according to official figures just issued. Steel production to September totaled 1,548,497 tons, against 1,300,033 tons and 813,309 tons in the same months of 1940 and 1939. At the end of August Canadian blast furnaces were operating at 79.4 per cent of capacity.

New Members Named on Valve, Turbine Groups

Washington

• • • **The OPM** Bureau of Clearance of the Defense Industry Advisory Committee last week announced the appointment of three additional members of the Steel Valve Industry Committee, originally consisting of nine members, and of a Turbine and Gears Defense Industry Committee.

The three new members of the Steel Valve Committee are:

M. S. Palmer, manager, Hancock Valve Sales division, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.; G. A. Daeuble, vice-president, Henry Vogt Machine Co., Louisville, Ky.; and M. L. Hough, president, Darling Valve Co., Williamsport, Pa.

Capt. J. O. Gawne has been designated government presiding officer of the Turbine and Gears Committee whose members are:

L. W. Crothaus, Allis-Chalmers Mfg. Co., Milwaukee; F. E. Burkhart, Bethlehem Steel Co., Quincy, Mass.; H. L. Watson, DeLaval Steam Turbine Co., Trenton, N. J.; W. L. Schneider, Falk Corp., Milwaukee; Austin Kuhns, Farrel-Birmingham Co., Inc., Buffalo; J. W. Belanger, General Electric Co., Schenectady; F. D. Newbury, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

109,000 Light Trucks Likely 5-Month Output

Washington

• • • **Depending** upon the availability of scarce materials, about 109,000 light trucks for civilian use may be produced during the five-month period ending Dec. 31, under an order issued last week by Director of Priorities Donald M. Nelson. This figure represents a reduction of 14 per cent below the same period last year, when approximately 127,000 light trucks —those less than 1½ tons—were produced.

If this production rate is continued for the full model year, the production for civilian purposes will amount to 261,000 units, compared with 370,000 in the last model year, or a reduction of 30 per cent.

WEST COAST . . .

• New War Department policy of regional buying seen as beneficial to Pacific Coast, where handicaps have been felt . . . Aluminum expansions temporarily bogged.

SAN FRANCISCO—No section of the country will benefit more than the Pacific Coast from the new War Department policy of regional procurement. This is so chiefly because up until this time no section has been laboring under such handicaps of high freight costs on materials and high labor costs as has the Coast.

Wide publicity has been given to this new Army procurement policy by which the total amount of any given type of material to be contracted will be split up and arbitrarily allocated among various sections of the country. On the portion allocated to the Ninth Corps area (the Pacific Coast) for manufacture, only the bids of Pacific Coast manufacturers will be considered. Thus, West Coast manufacturers will not have to compete against Eastern firms located closer to sources of material supplies or against Southern firms enjoying lower labor costs.

Turn to page 88 for IRON AGE data on "Selling to the Army — Where and How the War Department Purchases Metal Products."

Few realize the substantial succor this plan can give, particularly to aggressive small manufacturers. For instance, 26 Pacific Coast companies hold contracts for the manufacture of quartermasters' supplies. Army surveys show that 214 Coast firms are capable of making them. Official figures are not available, but the number of Coast firms holding ordnance manufacturing contracts could be counted on your toes and fingers. The ratio to those capable of participating in this type of manufacture is reliably understood to be similar to that in the quartermaster section.

THE Pacific Coast, and California in particular, has been the target of Midwestern criticism because it has received a comparatively larger share of defense awards than other sections, of the country, but close analysis shows that nearly all of this money is going for aircraft and ships. In California, defense awards are between three and four billion dollars. Col. F. E. Foster, chairman of the committee on industrial resources and production, California State Council of Defense, speaking before the State Chamber of Commerce last week, stated that the backlog of United States government contracts and other unfilled orders awaiting production in seven major aircraft manufacturing establishments in California is approximately $2,600,000,000. Reported U. S. government contract awards to these companies since June, 1940, total $1,435,287,931, a figure which is incomplete because no data have been released covering certain Naval and other contracts awarded. Total Naval and Maritime Commission contract awards or allotments for shipbuilding in California are close to a billion dollars, the Colonel said. The total including ships under construction for Great Britain and Navy yard construction is $1,087,432,152. Many small firms have been able to share in subcontracts for parts and components manufacture in these two classifications, but outside of these, the composite picture of small Pacific Coast industry is very much like that to be seen in any other section of the country. The new Army-Navy procurement policy is the first concrete tangible step that has been taken to throw a life line to the small firms.

"Throwing a life line" is no mere figure of speech. THE IRON AGE has learned, on unimpeachable authority, that when the plight of firms about to go under is called to certain procurement agencies, procurement lists will be scoured for a possible item award of which would keep them afloat. This is made possible by a recent change in policy which makes it possible to take informal bids, and which does not compel awards to the low bidder. Some criticism will no doubt be heard sooner or later on a corrollary of this policy by which only awards in certain fields are made public; neither bids nor bidders' names are released.

BY no means all manufacturing firms will be able to share in Army contracts however, even under this liberalized procurement policy. Firms are required to submit with their bids filled-in questionnaires concerning their labor supply, plant facilities, and tools and equipment, and financial set-up. No plant which requires more than 10 per cent of new tools or equipment to participate will receive an award without specific authority of undersecretary of war. Awards will be withheld, also, in those cases where plant construction costing more than $20,000 is involved.

Material shortages curtailed operations of five Los Angeles plants last week and 340 men were laid off. Significantly, in only two of these cases was the shortage in metals. One of these was a furniture company, whose shortage was wire, another a foundry, whose shortage was pig iron.

Activities of independent agents organizing production pools with the understanding that they will obtain government contracts for these pools on a commission basis have been reported, according to the OPM Division of Contract Distribution. Warnings have been issued to small manufacturing firms to steer clear of any such arrangements. Col. F. M. Smith, San Francisco, manager of the Division of Contract Distribution, told the California State Chamber of Commerce last week that contracts would have been more widely diffused now, had small firms been able to foresee their present situation six months ago. Colonel Smith said that contracts will start to flow to small firms within from 60 to 90 days.

NO praise whatsoever has been heard for the speed with which aluminum capacity is being expanded on the Coast. Six months ago, it was definitely recommended that plants be erected at Spokane and Tacoma, Wash., near Bonneville Dam, Ore., and in Los Angeles

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No machine builder could afford the exceptional care . . . the precision methods . . . the exhaustive tests used in building Twin Disc Clutches . . . merely to build a clutch for his own machines. His clutch volume would be too small to even justify the cost of setting up for it.

But by specializing exclusively in the manufacture of fine clutches for a variety of industrial uses, the Twin Disc Clutch Company has made it commercially practicable for any builder—no matter how small his volume—to equip his machines with the best friction disc clutches . . . assure his customers better clutch performance . . . longer clutch life . . . at a lower cost per unit.

Because he must satisfy both the machine builder and the machine operator, the clutch specialist "is in the middle" . . . he must be doubly sure that he is right. That's why so many nationally-known manufacturers entrust all their clutch problems to the TWIN DISC CLUTCH COMPANY, 1370 Racine Street, Racine, Wisconsin.

UPPER LEFT: *Twin Disc Model MT Duplex Machine Tool Clutch.*

LOWER LEFT: *Twin Disc Power Take-off.*

LOWER RIGHT: *Twin Disc Model E Heavy-duty Clutch.*

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

So far as THE IRON AGE has been able to learn, these projects are still in the stage of wrangling over who is to build the plants and who is to operate them. No definite inquiries have come onto the local market for the fabrication and erection of structural steel for these plants nor for the fabrication of pot shells, phases which could have been under way while operating technicalities were being threshed out.

The West Coast steel expansion program has moved considerably faster. The lapse between submission of the Hauck report and announcement that the Defense Plant Corp. would construct a $35,000,000 plant at Provo, Utah, to produce 725,000 tons of pig iron annually was only 30 days. The Provo plant will be operated by Columbia Steel Co. Approval was given within the same length of time for Defense Plant Corp. financing of a $700,000 expansion of the plant of Pacific Car & Foundry Co. at Renton, Wash. This plant will be able to make large size castings for shipbuilders of the Puget Sound region which heretofore have had to be imported from California.

Magnesium production plans of the Chemical Engineering division of Todd-California Shipbuilding Corp. whose plant is located in Permanente Canyon near Los Altos, Cal., now call for 20,000 tons annually. Dr. F. J. Hansgirg, inventor of the reduction process used at the Permanente plant, says that first commercial production costs are running from 10c. to 12c. a lb. for magnesium with a purity of 99.996 per cent. Closer competition with aluminum as an aircraft metal, if this record can be maintained, seems assured.

CAPT. HOWARD L. VICKERY, in charge of the Maritime Commission construction program told reporters last week that Pacific Coast shipyards are far ahead of East Coast yards in building emergency cargo ships, but that this coast is lagging in the construction of standard cargo vessels due largely to delays in delivery of steel. Another bottleneck, he reported, is the inadequacy of turbine and gear producing capacity, which he believes will be overcome by next fall. Commenting on the proposal to arm merchant ships, he said that every Maritime Commission ship designed in the last four years has included provisions for the mounting of guns. No alteration of standing designs will be required, he said. Changes of designs of the emergency class of ships providing larger engines may be made in the future, he said. Designs of ships now under contract will not be changed, as engines have been ordered for all of them.

Captain Vickery said that the Maritime Commission will be able to take over and operate the Todd-California Shipbuilding Corp. plant at Richmond, Cal., next July, five months ahead of schedule. The Commission has arranged to take over the six million dollar plant, which went into operation last February, upon completion of its contract for 30 freighters for Great Britain. The fifth of these vessels was launched last week.

NEW TANK TURRET: Here is a closeup of one of Britain's newer tools of war, a Matilda tank, showing the gun turret and armament of this new-type mobile fort.

Photo by British Combine.

Small Illinois Towns Report Job Losses

Chicago

• • • **Employment** declines have set in among a number of small Illinois towns, according to the state department of labor. Hardest hit town was Belleville, whose stove and leather manufacturers were so pinched by shortages of materials that employment declined 7.3 per cent in September. Moline followed with a 6.6 per cent drop in employment and 2.2 per cent in payrolls. Other cities showing declines were Aurora, Bloomington, Rockford, Springfield, Sterling-Rock Falls. September employment in the whole state increased only 0.4 per cent compared to the 1.2 per cent average increase that has prevailed in the state for this month since 1923. However, Illinois employment in September, 1941, is 21.1 per cent higher than it was in the same month a year ago.

California Defense Clinics Postponed to November

San Francisco

• • • **Defense production clinics** at San Francisco and Los Angeles designed to encourage subcontracting have been postponed from the last week in October to Nov. 17 and 18 for the Los Angeles clinic and Nov. 24 and 25 for San Francisco's. Morgan Craft, Los Angeles district manager for the OPM Division of Contract Distribution, is chairman of the southern California clinic committee and Col. Frank M. Smith holding the corresponding position in San Francisco is northern California clinic committee chairman.

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AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

Fatigue Cracks

BY A. H. DIX

Blondes, Flies and Air Raids

• • • Elsewhere in this issue the brains department reports to you upon the utilitarian aspects of the National Metal Exposition, but we feel that we owe it to this page's army of 18 loyal readers to comment on the big show's more unique features, such as the strikingly realistic illusion of hot metal flowing from ladle to ingot mold in the U. S. Steel exhibit, the blonde and brunette hostesses in the Lindberg Engineering display, Armco's simulated air raid, and the flies in our own booth.

We understand that the secret of the hot metal flow illusion was a brightly lighted neon tube, which was projected swiftly from the bottom of a full-size model of a ladle, into full-size models of ingot molds. The illusion was heightened by the simultaneous ignition of a magnesium flare, the kind with which photographers smoked up the atmosphere of banquets before flash bulbs were developed. The effect was breath-taking.

As also were the blonde and the brunette hostesses in the Lindberg display. We believe that the exposition as a whole profits by the injection of soothing intervals in the endless process of products designed to increase the convexity of your coffers and smooth the furrows in your brow. The mind can absorb just so much at one sitting.

Armco put a party of us through a simulated air raid—in a genuine shelter, the kind with a corrugated curved roof. In darkness we heard everything from the shrill alarm, the bombardment, to the final "all clear." It erased for the moment the 3000 miles between here and the war. The experience was genuinely frightening. as proved by the forced attempts at humor that men indulge in when they are scared and are trying not to show it.

Our own booth was a brave attempt to provide the ultimate in comfort, creature and otherwise—soft chairs on deep pile carpet, telephone, Dictaphones, stenographer, messenger, reprints of the priority guide, the tool steel comparison chart, and the dozens of other fruits from the brains department's lavish horn—even telegrams from Washington reporting on the latest priority developments. But we had overlooked one thing—fly-swatters. We have seen more flies in one place but we have never seen flies so indomitable and affectionate. It's always something.

He Got Red

Don't mention letterpresses. When I got my first job with the Home Insurance Co. away back when, an early assignment was to index in an A to Z book the names to which some hundreds of outgoing letters had been sent, as recorded in the letterpress copy book.

By following instructions strictly, I did it; but my downfall came when they handed me some 300 incoming letters, without bothering to furnish more instructions. I indexed the whole batch under "Home Insurance Co.," to which they were addressed.

The word "letterpress" makes me think of what H. F. Quinn said to me, and even now I blush.

—*Deac*

Sandburg Revised

• • • *Tide*, the advertising journal, says that CBS, the radio network, recently submitted a certain steel company a sample script for an air show, using as a background Carl Sandburg's "Smoke and Steel." The poem contains this carefully balanced line:

"Homestead, Braddock, Birmingham, they make their steel with men."

According to *Tide's* story, the manuscript came back with the line altered to include the names of the towns in which the company has plants. We don't believe it. The steel advertising and publicity people that we have met are men of high cultural attainments, and in any test of literary knowledge they could give cards and spades to radio script writers. The story is doubtless of a piece with the famous canard about the Beecham's pill people handing out free hymn books with an extra verse buried in the middle of the book, beginning:

Hark the herald angels sing,
Beecham's pills are just the thing . . .

Malt Miltons

• • • Speaking of poetry, we thought you would like to know of the trend toward tight little rhyming capsules in beer and liquor slogan circles. From *Printers' Ink's* latest list we glean these:

Don't be vague—Ask for Haig
Class in a Glass
Peer of Beers
Taste Without Waist

The only rebel is Trommer, who scorns both rhyme and cadence with the mild 3.2 "Peak of Beer Flavor."

He Saw Red

• • • The week's grammar lesson is contributed by A.D.W., who is apoplectic over an advertiser's use of the phrase *"a true fact."* Although, according to the book, *true* is redundant, we can't work up a sweat over it. *True* emphasizes the meaning of the noun. In a recent broadcast the President spoke of *soporific lullabies.* A lullaby, unless sung by Ella Logan or Maxine Sullivan, is a sleep-inducer, and so is *soporific*, but the adjective reinforces the noun and the phrase gains strength.

At sight of the phrase "little booklet" there are those whose adrenal glands start laboring like the engine of a tugboat moving upstream against an outgoing tide. But the phrase is useful because *booklet* has come to mean a book with a small number of pages. A big booklet is one with large pages, and a little booklet one with small.

If a phrase can be made more forceful at the expense of a small dog ear in the grammar book, we are all for it. The letter killeth.

Apology

• • • Truth compels us to retract our recent boast that your favorite family journal is the only publication that has scored in each of the four years *Industrial Marketing* has conducted its contest for editorial excellence. *Metal Progress* also has a perfect record. Sorry.

Stoppers

• • • 28-hour days for sale!—*Parker-Kalon.*

The case of the unhappy saw maker—*Disston.*

Take a bolt of lightning to all offices, Miss Smith—*Bell System.*

Here I sit—holding up the defense program!"—*Dictaphone.*

Puzzles

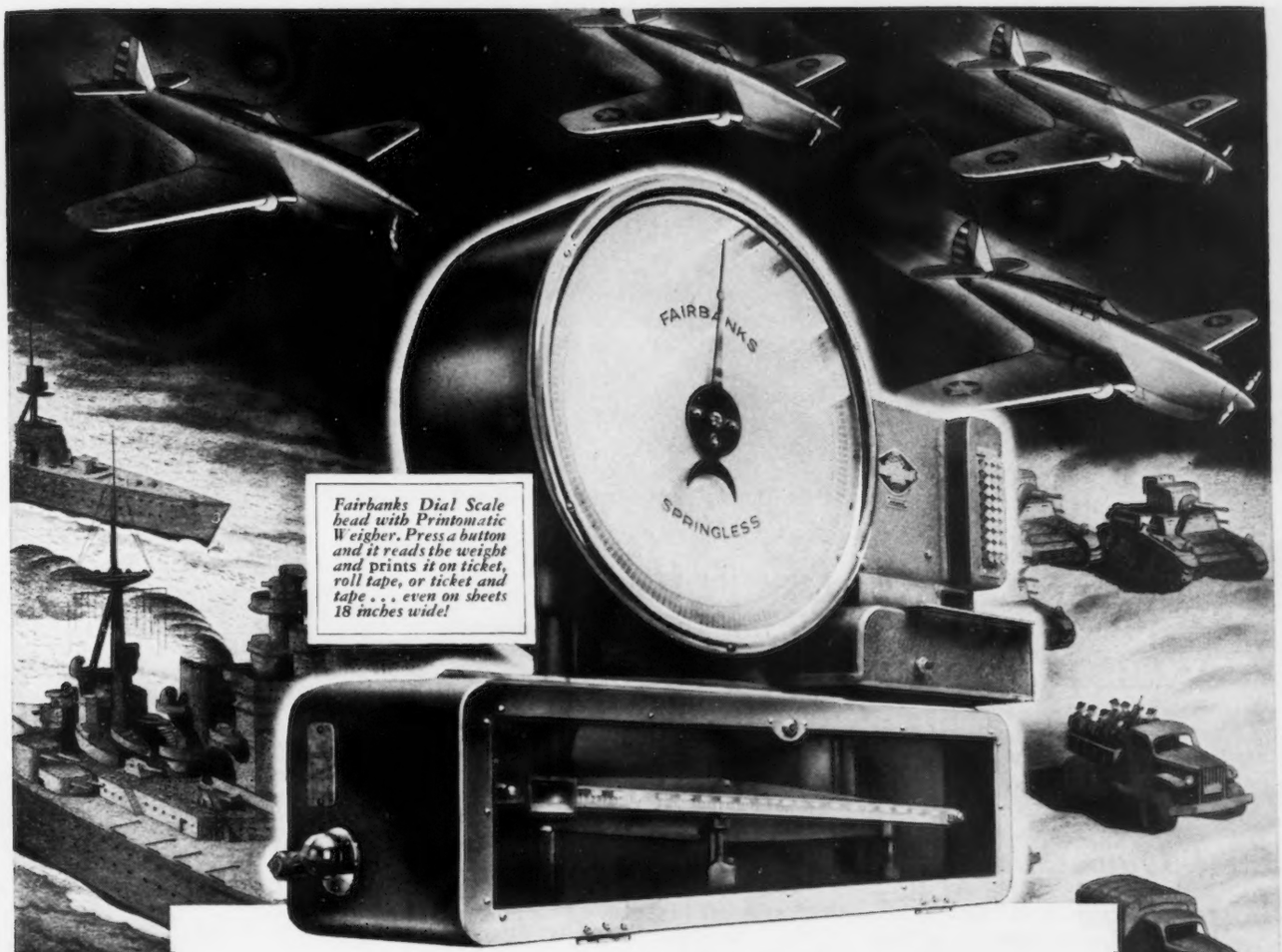
As you saw instantly, the answer to last week's sound travel trifle is 5 seconds.

This mountaineer marriage problem, submitted by Thomas Cannarella, provides you with this escape from the war news:

On their wedding day, a man was twice as old as his bride. When the wife's age doubled, the combined ages of their boy and girl equalled the difference in the parents' ages.

At the present time the daughter is 4 times older than she was then, and the combined ages of the boy and girl are equal to the mother's age, who is now as old as her husband was when he was 1½ times as old as she.

Six years ago the son was 2 years older than his mother was on her wedding day. What are their ages now?



Fairbanks Dial Scale head with Printomatic Weigher. Press a button and it reads the weight and prints it on ticket, roll tape, or ticket and tape . . . even on sheets 18 inches wide!

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● Whether you are working on defense contracts, or supplying manufacturers who are, you've got to work fast, or you . . . and your country . . . may lose!

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They weigh *faster*—even while materials are *on the move.* They weigh and disburse preset amounts *automatically.* They *print* records and receipts. They *count* small parts and products. And they *eliminate human errors* in reading and recording weights and in interpreting scrawled weight records.

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DIESEL ENGINES ELECTRICAL MACHINERY RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

This Industrial Week . . .

o o o

BY midweek operators of many U. S. defense and non-defense plants were meditating on the meaning of the word "invasion." It seemed there were two meanings for this word. Not yet invaded by a foreign army, industry found itself threatened by labor leaders already inside the national fortress.

The coal strike, so dangerous to the national defense program that it seemed destined to a swift death at the hands of an aroused public, had an immediate effect on steel output, and more vital statistics on the strange situation whereby a few labor leaders (not the rank and file of workers) are able to cripple defense work began to come out.

The loss in steel output for this week, if the strike in steel company-owned coal mines continues through the week, will be about 55,000 tons for U. S. Steel Corp. plants alone, including 11,000 tons in the Youngstown area, 14,000 tons in Chicago and 30,000 tons at Pittsburgh. Heavy losses in production will inevitably be reported soon by other large steel companies if the coal strike continues since almost all steel companies are short of coal supplies due to the coal strike earlier this year.

Steel Output Losses Begin

The SWOC effort to establish the closed shop and the dues checkoff in the steel and allied industries, and thus win financial security for itself is, of course, the reason for the coal strike which at midweek had passed out of industry's control and to President Roosevelt for settlement.

While security of the country itself seemed to be involved in the Roosevelt-Lewis struggle for control of the defense program, many classes of innocent bystanders were being trampled. Among these are the non-defense plants which are unable to get enough, or in some cases any, steel, under the present priorities system. In many cases a few hundred tons of steel would permit them to stay in business. To see thousands of tons of steel lost because of the coal strike, and because of other strikes occurring in the last few months, put the steel consuming plants suffering from priority rationing in a special class of mourners over the strikes.

The Innocent Bystanders

How deeply the priorities system is cutting into U. S. industry was again emphasized this week as THE IRON AGE priority poll of metalworking plants reached an advanced stage. Fifteen hundred plants have now filled out a questionnaire which seeks to show the effects of priorities on defense and non-defense plants in the metal products industry. Of these 1500 companies, 403 report a curtailment in operations because of priorities, while 912 declare that, so far, they have not yet suffered because of the operations of the priorities system. Other companies did not answer the question as to whether priorities have curtailed production but did report themselves affected by shortages.

Priorities Hit 403 of 1500

The number of companies reporting to THE IRON AGE a shortage of steel (not necessarily reducing operations but in some cases slashing inventories) has now reached 497 out of 1500. Evidently the flood of priority ratings is keeping steel away from a large number of non-defense and some defense plants which could profitably use the excess material being directed to some priority-favored steel-consuming plants. In the latest 1000 companies to mail questionnaires, 50 companies reported a shortage of steel sheets and 26 others a lack of plates.

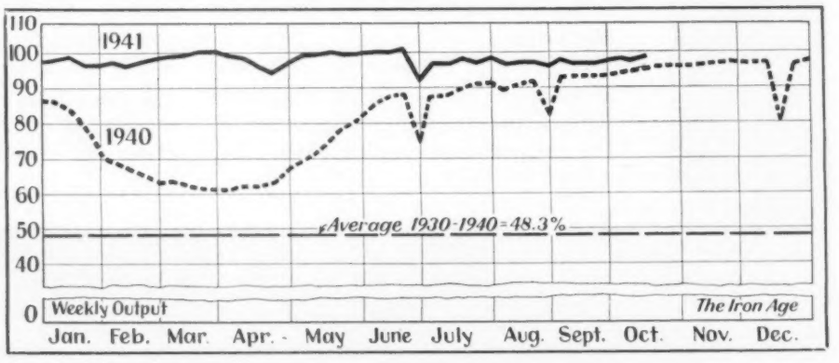
One hundred and eighty-eight companies of the latest 1000 to report in the priorities survey declare themselves short of non-ferrous metals. These include 46 short of brass and 33 short of aluminum. Machine tool, small tool and "other machinery" shortages were reported by 85 of the latest 1000 companies to report.

Meanwhile, steps to divert needed materials from civilian to defense products are coming thick and fast. A 35 per cent reduction in steel consumption by the non-mechanical ice refrigerator industry, from the period from Sept. 1, 1941, through Dec. 31, 1941, has been ordered by Priority Director Donald M. Nelson. This step will save about 5000 tons a year, a total which the industry affected is bound to compare with the steel losses developing out of strikes. The OPM action in ordering automobile manufacturers to discontinue the use of metal finish and bright work in body trim and accessories after Dec. 15 is likely to be the forerunner of even more drastic steps to be taken under the

Less Steel For Refrigerators

Steel Ingot Production—Per Cent of Capacity

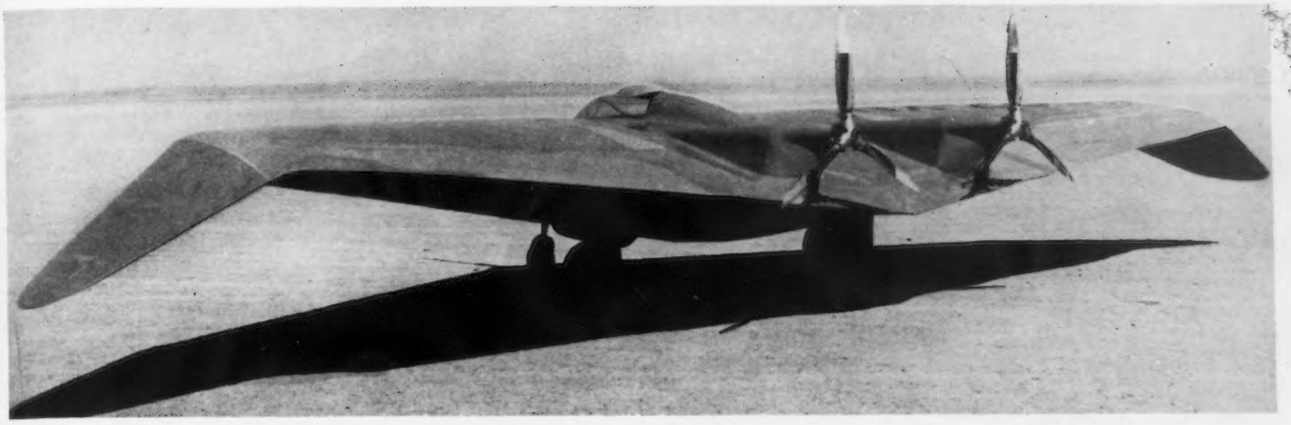
(Open Hearth, Bessemer and Electric Ingots)



Steel Ingot Production, by Districts—Per Cent of Capacity

	Pittsburgh	Chicago	Valleys	Philadelphia	Cleveland	Buffalo	Wheeling	Detroit	Southern	S.Ohio River	Western	St. Louis	Eastern	Aggregate
Current Week.....	97.0*	97.0*	94.0*	91.5	102.0	94.5	94.0	112.5	99.0	105.0	97.0	99.0	104.0	94.5*
Previous Week...	99.0	102.0	98.0	90.5	102.0	94.5	94.0	39.0	99.0	103.0	97.0	99.0	108.0	96.5

* Preliminary



FLYING WING: Designed and constructed by Northrop Aircraft, Inc., of Hawthorne, Cal., the plane shown above is said to be the first successful true flying wing. It has no tail surfaces or auxiliary surfaces and no fuselage. Power plant and personnel are housed within the contours of the air-foil. The plane has a 38-ft. wing spread and two 120 hp. air-cooled horizontally opposed engines.

Administration's new plan to double the speed and scope of the defense program. Some observers are already speculating on how it can be carried out without bringing to a standstill the production of automobiles, refrigerators, stoves, washing machines and other consumer goods. Given time, the present priorities system seems likely to push such goods almost out of production regardless of other steps to limit output.

In the steel industry priority ratings constitute such a large percentage of current shipments that steel officials find the ratings are nullifying themselves.

More Tonnage Gets Ratings

Complaints of slow deliveries are reaching the mills in greater number with the answer always the same—higher ratings held back the material in question. Unless allocation of supplies is extended to more steel items, some holders of defense business soon will find themselves no better off than the non-defense plants.

Recent appointments by the OPM of more industry advisory groups, such as the turbine and gears industry committee, the steel valve industry committee and others, suggest that the way is already being paved for adoption of a general allocation system of distributing defense material and equipment. Such committees, which work with the OPM in figuring the material needs of their industries, could logically be a part of an allocations system. Given the overall tonnage available for each industry, based on its consumption figures in a peace-time year, these advisory committees could help allocate tonnages to individual plants.

Way Clearing For Allocation

Meanwhile the steel industry has served notice that there is already more steel to allocate than ever before. On Oct. 24, steel output in the U. S. for 1941 topped the 66,982,000-ton mark for all of 1940 and headed toward a new yearly record of around 82 million tons. Iron and steel exports from the U. S. in August gained 29 per cent over July to 617,477 gross tons but remained well below the August, 1940, total of 1,048,816 tons. This week brought another series of steel plant expansion announcements. OPM Director General Knudsen asked DPC to finance for Republic Steel Corp. a $35,000,000 plant at South Chicago, Ill., for production of electric alloy steel. The Republic program calls for one 1200-ton blast furnace and six 70-ton electric furnaces and represents slightly more than one-half the 1,000,000-ton alloy steel capacity increase asked in the recent Hauck-OPM steel report. The Defense Plant Corp. is to finance two new blast furnaces, with coking facilities, at Columbia Steel Co.'s Provo. Utah, plant at a cost of $35,000,000, and a seven-open hearth steel plant at Pittsburg, Cal., for the same company. The OPM soon is expected to recommend a thoroughly integrated steel plant which will be operated by Bethlehem Steel Co. at Los Angeles.

The steel scrap shortage this week was overshadowed somewhat by strike news but continued critical with shipments light in relation to consumption. The OPM is assembling mailing lists for distribution of forms which scrap producers, brokers and consumers must fill out starting Nov. 15 in connection with the recently announced full priority control over scrap. Affecting thousands of plants and individuals, the scrap order is one of the most sweeping taken so far.

Steel plant operations in the U. S. at mid-week were 94½ per cent, down two points from last week, but strike uncertainties make revision in the rate likely. The Pittsburgh rate slumped nine points to 90 per cent while Chicago dropped five points to 97 per cent with Youngstown off four points to 94 per cent.

Ingot Output Drops 2 Points

Fabricated structural steel awards dropped to 13,925 tons from 25,500 tons last week, with outstanding lettings including 2850 tons for a defense plant at Louisville, Ky., and 1800 tons for an airplane motors testing building for Chevrolet in Tonawanda Township, N. Y. New structural steel projects, lower at 10,655 tons, include 5500 tons for an ordnance machine shop at the Brooklyn Navy Yard. New reinforcing steel projects of 12,600 tons include 3007 tons for the Shasta Dam at Coram, Cal.

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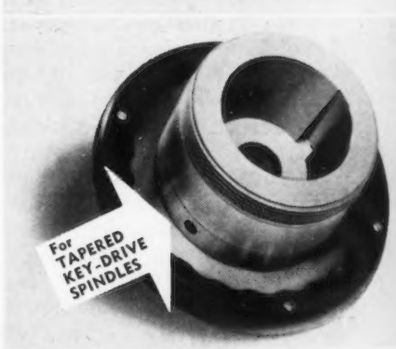
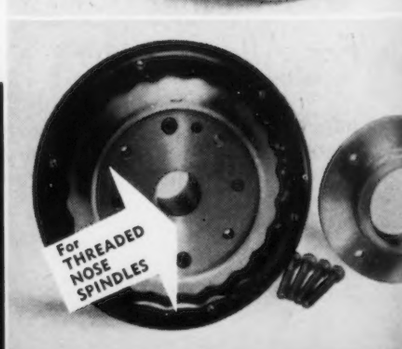




HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

News of Industry . . .

Analysis Shows Complications In Substitute Drive

By THOMAS C. CAMPBELL

Pittsburgh Editor

• • • **Finding** proper substitutes because of current shortages in some materials is more complicated and more far-reaching than generally supposed, according to an analysis drawn from current programs set up by various Westinghouse Electric & Mfg. Co. plants. This large company is so diversified that conclusions drawn from the study are in most cases applicable to industry as a whole, at least that part of industry producing the same or similar products or products requiring similar materials.

The lack of one type of material necessitating the substitution of another, leads, in many cases, to a maze where one small part or item could restrict or eliminate the production of the major article. Strikingly enough, it was found that the most popular substitute for many ferrous and nonferrous materials which have or will become unobtainable because of scarcity, is plain carbon steel either in bar or sheet form. The dictating factor then on many products will be the availability of ordinary steel products, while the second most important item which will control production of non-defense needs or even essential civilian items will be the availability of copper for production of motors without which most modern day home appliances or industrial machinery cannot be operated.

Generally speaking, it is apparent that substitutions which have been or will be necessary in the manufacture of consumer and industrial items, as well as the production of some defense products having low ratings, will produce the following major results: Increased cost to the manufacturer; inconvenience and delay in some cases; inferior but still acceptable finish in some instances but with consumers properly advised as to what to expect; and no ground for fears of proper performance value.

The increased costs in many instances have or will be brought about by higher cost of substitute material, increased handling or manufacturing technique, or a combination of both. Westinghouse officials pointed out that in as many cases as possible, substitutions, either in the form of material or technique, were restricted to those channels with which the company has had in the past or currently is having considerable experience. For example, the substitution of enameled sheets for copper alloy in the refrigerator evaporator, while presenting new manufacturing problems as well as handling difficulties, is not as serious as might appear because Westinghouse plants consistently have been turning out enameled sheet parts and are well acquainted with the procedure.

Inconvenience and delay will, in all cases, be due to revised delivery promises made to manufacturing concerns by producers of necessary materials needed in non-defense endeavors. This situation is referred to in some quarters as "one postponement after another."

Most cases in industry where a new finish will have to be provided will involve the use of paint or enameled sheets in place of aluminum or stainless steel finishes. While the results will not be as good from a lasting standpoint, manufacturers point out that the finish will be good and failures can be observed easily and properly taken care of. It is a case of doing the best with what is available.

In every substitution program which Westinghouse has approved or put into operation, no sacrifice in actual performance of the finished products has been made. Since this factor in equipment and products is a fundamental one, the acceptance of sacrifices in other directions will be more readily entertained by both the manufacturer and the consumer, especially when nothing can be done about it.

Photo by Harris & Ewing

NELSON OF SPAB: This is a new photo of Donald Nelson, executive director of the Supply Priorities and Allocations Board and head of OPM's Priorities Division.

An important by-product of the search for substitutes, according to Westinghouse officials, is the emergence of merit and ability by many employees which has been the direct result of a challenge to find new materials and new techniques in order to carry on until the emergency is over. A tremendous growth in solidarity and cooperation has also been a direct by-product in the search for substitutes.

Following is a thumbnail sketch showing a few of the problems faced by Westinghouse engineers and in a general way the solutions

which they believe to be satisfactory in case of necessity.

CONSUMER PRODUCTS

Refrigerators (Cabinet and Assembly)

Cabinet production is being restricted by the unavailability of sheet steel, hence output of refrigerators depends entirely on this factor, since no substitutes are being considered for steel in cabinet construction.

Handles and hinges, which have been made from zinc or aluminum die castings will have to go to ordinary steel or brass if available. For decorations, lead antimony alloy is being considered.

Cube trays which had been made from aluminum are now being, or will be, made from rubber, enameled steel sheets, or possibly plastics.

Compressors will continue to be made from cast iron and sheet steel as long as supplies are available and motors will be available as long as copper is obtainable.

Electric Ranges

Cabinets or frames will be restricted in accordance with availability of enameled steel sheets.

Heater tubes are to be made from high chrome steels instead of special stainless steel, requiring some change in manufacturing technique. If high chrome steels become unavailable, it may be necessary, if production is continued, to revert to the solid-top cast-iron heater used by the industry a number of years ago. The last resort would be the adoption of the open-coil ceramic-type heater.

Resistance wire made from nickel chrome steels is in a tight position and if supply is unavailable, other steels will have to be used or no heating units can be made, thus restricting stove production.

Cooking well previously made from aluminum will have to be made from enameled sheet steel.

Electric Roaster

Covers previously made from aluminum must be made from other metal. Copper was proposed but is now unavailable. Enameled steel is being considered. The use of enameled steel lids instead of aluminum lids has a tendency to increase the operating costs due to the additional mass and a subsequent slight increase in heat losses.

Miscellaneous — Trim, frame and resistance wires will be handled same as shown under stoves.

Domestic Laundry Equipment

Frameworks or tubs restricted by availability of sheet steel.

Parts and agitators, most of which have been aluminum die cast material, will be made from rubber, Capaco brass, plastics or enameled sheet steel, or a combination of these materials.

Miscellaneous—Production also controlled by the availability of motors which cannot be made if copper becomes completely unavailable.

Fans

Base heretofore made from zinc die castings will be made from cast iron. Availability of motors will be controlling factor.

Vacuum Cleaners

Parts previously made almost entirely from aluminum die castings are being made from plastics or, if possible, half plastics and half aluminum. Elimination of die castings presents new machinery problems and possible farming out of some parts made from plastics. The latter must be made from bases other than those containing formaldehyde which is on the priority list.

INDUSTRIAL PRODUCTS

Lighting Items

Luminaire parts previously made from non-ferrous metals

ARMORED TRAIN WRECK: This armored train, which mounted a fairly large caliber gun was wrecked when German planes blasted out a bridge somewhere on the Russo-German front, according to the German caption. The Russians are said to put much faith in this type of train.

Photo by International

now on priority list unless for defense purposes will for the most part be made from sheet steel, while cast iron will take the place of various aluminum, brass, and bronze alloy castings.

Reflectors which heretofore were made from special sheet aluminum will be made in some cases from iron sheet with a high reflecting porcelain enamel finish. New glass reflectors with special silvered finish have been designed and are now in production.

Watt Hour Meters

(Outdoor for Residences)

Sockets, which enclose the outdoor service wiring and into which the modern watt hour meters are plugged, were heretofore aluminum die castings. While aluminum had certain advantages for outdoor locations, a satisfactory substitute has been developed by the process of drawing the sockets from sheet steel and then applying a weatherproofing finish. Nor was the necessity for substitutions confined to the socket. In the meter a copper disk and a brass shaft were substituted for the aluminum disk and shaft used in the rotor. The increase of weight, fortunately, does not adversely affect the long life of the bearing, due to the high efficiency of the double-jeweled ball bearing which has been a feature of Westinghouse meters since 1902.

Similarly, substitutions have been developed for the aluminum die cast permanent magnet clamp. Still another substitution is the use of cast iron bases instead of aluminum bases for the front-connected types of meters, which are still being used for indoor mounting in connection with the older types of meter installations.

Electric Lamps

Supports in lamps now made from nickel will have to be made from nickel plated steel if nickel becomes unavailable and in certain sizes and certain places copper may be used. Lamp bases now made from brass may have to be made from nickel plated steel or steel with copper plating or gilding metal if brass becomes unavailable. Such substitutes present complex heat treating problems which would be bad news in the initial change-over period.

Photo by World Wide

STEEL STRIKES: Strikes which threaten the steel industry's continued production for defense start from a variety of causes. The Great Lakes Steel Corp. strike at Detroit broke out again last week when Orval Kincaid, a leader of the SWOC, refused to resign as requested by some members of the union. Kincaid had refused to reinstate leaders of the outlaw strike.

Insulation

(Constituents: Fabric, Mica, Paper, Varnish)

Fabric—Silk so far is available but present plans call for a change-over, as it becomes necessary, to cotton, glass, or asbestos.

Mica, bulk of which comes from India, may be hard to get because of scarcity of bottoms or for other reasons. Developments in Mexico and South America hold out promise of supplies from those places.

Jap paper which for years consisted of a Japanese product, being thin, strong, flexible, and made from mulberry fiber, may give way to a domestic paper made from old rope and on which experimentation and research started six years ago. No trouble expected here because of successful application of domestic paper.

Varnish problem involves tung oil, a drying agent, 97 per cent of which comes from China and three per cent from Florida. In case of shortage due to lack of bottoms or international situation, several substitutes have been advanced as follows: Dehydrated castor oil developed by Sherwin-Williams Co.; soy bean oil; cashew nut oil also from Brazil; and oiticica oil from Brazil.

Shellac which comes entirely from India, has so far no satisfactory substitute and availability of ship bottoms will determine the supply.

Waxes for filling compound, especially Montan wax from Germany, has been successfully substituted but details are not available.

Steel

Note: The following brief review applies to steels used almost exclusively in national defense or priority rated work, thus the availability of non-defense steel requirements can be surmised from this analysis:

General—In every case where a specific steel is needed, an analysis is set up which shows why it is used by listing the reasons, all of which must be essential, and determining where proper substitutes can be used without change in performance or physical or chemical specification. Such relaxations in applying the material unavailable by the substitution of something of a grade which will

Revisions For The Iron Age Priorities Guide

(Make the following changes in your IRON AGE Priorities Guide No. 2 to keep it up date. The No. 2 Guide is the 8-page insert which appeared in the Oct. 23 issue of this publication).

Following changes are to be made in section "Description of Priority Orders" on page 2 of the Priorities Guide.

Order P-5—delete related form PD-6
Order P-6—add forms PD-25-d and PD-25-e
Order P-6-a — delete related forms PD-25-b and PD-25-a
Order P-11-a—insert PD-81 in column "Related Form"
Order P-18—insert PD-6-Rev. in "Related Form" column
Order P-18-a — insert related form PD-81
Order P-22 — immediately following insert "P-22-a . . . Repairs and maintenance (superseded by P-22)"
Order P-26 — immediately following Order P-25-e insert "P-26. . . Material for medium tanks"
Order P-29 — insert related forms PD-79 and PD-80
Order P-31 — insert related form P-D 81
Order P-32 — change related form from PD-81 to PD-88
Order P-33 — change related form from PD-88 to PD-81
Order P-39 — insert related form PD-81
Order P-32 — insert related form PD-6
Order P-43 — delete related form PD-107 and replace with PD-93
Order P-47 — delete related form PD-81
Order P-52 — delete related form PD-108 and replace with PD-81
Order P-53 — delete related form PD-88 and replace with PD-81
Order M-8 — insert related forms PD-28 and PD-29
Order M-9 — delete related forms PD-28 and 29 and replace with PD-37.
Order M-14 — insert related form PD-101
Order L-1 — insert related form PD-95
Order E-2-a — delete word *revokes* and substitute *supersedes*

In section on page 6 entitled "Forms to Use with Priority Orders" make following revisions:

PD-14—change P-3 to P-4
PD-23—has been withheld, insert the word *withheld* to so indicate
Insert PD-28—affidavit of compliance with cork order
PD-34—has not been issued, insert words *not issued* to so indicate

The following PD forms should be added in their proper numerical position:

PD-51 — monthly cork allocations
PD-61—output and shipments of duty free copper
PD-66 — lead requirements in connection with Order M-38
*PD-74 — report of orders to which rating assigned by Order P-24 has been applied
*PD-74-a — certification to accompany PD-74
*PD-75—request for alloy iron or steel
PD-80—report of re-extension of Health Supplies Rating Order
PD-83—report of material requirements of warehouses
PD-89 — report of farm machinery and equipment
PD-95 — application for preference rating in connection with Order L-1
PD-120 — Dealers' report on scrap metal. (Not issued)

* May be reproduced without change of text.

Types of Plants Answering Poll

• • • The latest 1000 companies to report in THE IRON AGE priorities survey on effects of priorities on production listed their principal peacetime product as follows:

54 Auto. and accessory mfg.
24 Agricultural machinery and implements
38 Machine tool
69 Other machinery
15 Aircraft and marine parts
25 Electric motors, controllers and elec. prod.
109 Foundries and forge shops
12 Railroad equipment
17 Oil and mining equipment
37 Tanks, boilers and power plant equip.
47 Job shops and repair shops
67 Small tool, die, and gage
76 Metal working, stamping, spinning, forming
23 Non-ferrous casting, refiners & processors
21 Steel jobbers and warehouses
29 Hardware
4 Abrasive
25 Screw machinery products
8 Machine designers and engineering
37 Indus. & mill suppliers
46 Struct. steel fabricators & ornamental iron
13 Tube and pipe
4 Hospital, surgical and dental supplies
11 Metal treating and equipment
80 Civilian commodities, refrigerators, stoves, etc.
19 Road building and rock machinery
4 Photo & radio supply
8 Laboratory equipment
13 Refractory material
7 Food processing equipment
58 Others

be satisfactory performance-wise, is only "for the time being." However, in all probability some of the substitutes will become "regulars" after the emergency is over.

Motor shafts which call for SAE 3135 have been made satisfactorily from heat treated carbon steel and alloy steel No. 4140.

Tool steels—Molybdenum steels in place of 18-4-1 steels are being used for cutting tools. Lower alloy steel is being substituted for 14 per cent tungsten tips.

Nitriding steel for circuit breakers in sheet form is a special steel not always available when wanted. A proper heat treatment has been developed for 13 per cent chromium sheet steel which is more readily available.

Blanking dies are being made from high carbon high chrome instead of 18-4-1 steel, of which most applications require readjustment in heat treating technique.

Miscellaneous—Stock room supplies of high nickel steels have recently shown 60 to 80 per cent "stock out" or unavailable in the size and grade needed at that time. There is a temporary tendency to use a suitable steel which is available, even though the cost is much greater than the cost of the unavailable steel. In special cases such procedure makes it unnecessary to carry specific stocks of the unavailable item. The infrequent demand and the small tonnage involved makes the increased cost of using a more valuable steel give way to expedient and time-saving factors. Such procedure has also resulted in a simplification of stocks dictated by using what is on hand by proper application.

403 of 1500 Plants In Iron Age Poll So Far Hit By Priorities

• • • **Shortages of materials** have reduced output of 267 of the latest 1000 metal-working companies to report in THE IRON AGE Priorities Poll.

This week, as last, the companies answering questionnaires sent to determine the effects of priorities on industry, report that an average of 60 to 70 per cent of their business consists of defense orders.

A perhaps unexpected development in the poll, which covers a cross section of a large percentage of THE IRON AGE subscribers, is the number of plants which cannot reach capacity production because of lack of skilled labor. Of the latest 1000 companies to report, 219 or more than one-fifth, report labor shortages.

In the first 1500 companies to submit answers asked in THE IRON AGE poll, a total of 403 companies reported a curtailment in operations because of priorities, while 912 companies declare that, so far, they have not suffered because of the operations of the priorities system. Many companies did not answer the question as to whether priorities have curtailed production but did report themselves affected by lack of materials and equipment.

Three hundred and twenty-seven of the latest 1000 companies polled announce that they are suffering from a scarcity of certain steel items. This figure evidently includes some companies that have merely seen their inventories reduced through efforts to divert steel to defense plants although the poll question covering this point asked: "To what extent has operation of your plant been reduced by priorities?"

Uneven working of the priority system is undoubtedly a factor in the high percentage of companies reporting output affected by scarcity of steel and other vital materials. Priorities might pile up steel at some points, such as a Navy Yard, and cause shortages for individual steel consuming plants. Thus there might not be an industry-wide shortage of steel but shortages in certain sections and among individual plants because of priorities ratings. A flood of high priority ratings apparently is keeping steel away from a large number of defense and non-defense plants which could profitably, from a viewpoint of the defense program and of employment, use the excess material being directed to some favored plants. Some observers see direct allocation of steel as an answer to this problem.

Of the first 1500 plants polled, in THE IRON AGE survey poll to date, a total of 497 say they lack steel.

In the latest 1000 questionnaires to be analyzed, excluding the returns from the first 500 carried in the Oct. 23 issue of this publication, the 327 reporting a scarcity of steel includes 50 companies short of sheets and 26 lacking

THIS WEEK'S Priorities and Prices

Automobile makers prohibited, after Dec. 15, from using bright finish, bright work, metal finish or body trim containing aluminum, copper, nickel or chrome by Order L-2-b. (OPM:PM1447)

Lead refiners instructed to set aside 15 per cent of November output for emergency use. (OPM:T26)

High cost copper producers, the Copper Range Co., Isle Royale Copper Co. and Quincy Mining Co., receiving prices above OPA ceiling. Contracts with these higher prices "have full approval" of OPA. (OPA:PM1414)

Light truck production for civilian use will be curtailed in December, also. Approximately 109,000 light trucks may be produced in August-December period. (OPM:PM1432)

Die Casting Defense Advisory Committee formation announced by OPM. (OPM:PM1422)

Wood pulp makers have withdrawn proposed fourth quarter price increases at request of OPA.

Waste paper consumption in Eastern mills cut 10 per cent for period from Oct. 25 to Nov. 22 in Limitation Order L-15 issued Oct. 25. (OPM:PM1426)

Scrap steel price ceiling violators being cracked down on by OPA. A second "proven violator" forced to agree to refund all sums collected in excess of official ceilings, while cases against other violators are being prepared. (OPA:PM1434)

Contract Distribution Division of OPM opens a new office at 1002 Union National Bank Bldg., Youngstown. (OPM:PM1435)

New steel plant near San Francisco recommended by OPM. Proposed plant would have an annual capacity of 500,000 tons of plates and 30,000 tons of castings. (OPM:PM1438)

Priorities Division of OPM opens new field offices at Dayton, Ohio; Tulsa, Okla.; Milwaukee, and Hartford, Conn. (OPM:PM1445)

Prices of copper, brass and other copper base alloy products are to be stabilized shortly. Items to be covered include building hardware, non-ferrous foundry products, brass rods, sheets and tubes, as well as other durable goods containing copper. (OPA:PM1446)

Zinc dust prices adjusted upward to 10.35c. a lb., for carloads or more in the East and 12.25c. for the Pacific Coast. Revision caused by recent increase in primary prices. (OPA:T27)

Civilian aircraft preference rating of A-10 extended to include repair parts and accessories in amendment to Order P-6. (OPM:PM1444)

Preference order P-3, covering airframes, extended to Dec. 31, 1941. (OPM:PM1443)

★ ★ ★

For copies of above announcements address defense agency concerned, at Washington, giving announcement number as shown in parentheses after each paragraph (OPM:PM1300 means announcement 1300 issued by Office of Production Management.)

plates. Some of the other companies of the 327 reporting steel shortages included 18, short of bars; 17, tool steel; 17, alloy steel; 18, bars; 15, cold rolled steel; 15, pig iron; 16, castings and cast iron; 13, structural shapes; 11, stainless; 9, pipe and tubing; 10, scrap; 7, strip; 13, wire and springs and 3 small shapes.

One hundred and eighty-eight companies of the latest 1000 to answer the questionnaire declare themselves short of non-ferrous metals. These included 46 companies short of brass; 34, aluminum; 33, copper; 14, nickel; 12, bronze; 10, zinc; 5, cadmium; 3, chromium; 2, nickel-silver; 2, monel; and one each, lead, magnesium, manganese and molybdenum.

Machine tool, small tool and "other machinery" shortages were reported by 85 companies of which 17 need tools, dies, drills, files, etc.; 7, metal cutting tools and machines, exact type not noted; 3, screw machines; 3, grinders; 7, lathes; 2, milling machines; 2, boring mills, and one, punch press.

Of the 219 companies lacking skilled labor, 25 specify that they need machinists; 11, molders; 8, tool makers; 6, lathe operators; 5, core makers, and 5, welders.

Comments written on the returning questionnaires show that many metalworking companies which have not yet suffered from shortages of materials under the priorities system are looking for trouble. "It won't be long now," many of them wrote. Typical comment follows:

"I think F.D.R. wants to kill Hitler, but I've never heard of guns and shells from reclaimed priority forms."—LUBRICATING DEVICE MAKER, Pa.

"Our man hours loss over priorities is about 50 hr. a month lost in cleaning up priority forms, affidavits and other nonsense."—METAL PRODUCT PLANT, Pa.

"We will have to close our plant Nov. 1 if we do not have steel." —FARM MACHINERY MANUFACTURER, N. Y.

"We feel that there should be a little cooperation, also, on the part of authorities placing materials in the smaller shops and not allowing the entire amount of business to be given to a few of the larger corporations. Repeatedly we have written to the various (government) departments asking if our name could be placed on their active lists and have not received a single reply or inquiry from them." — STRUCTURAL STEEL ERECTORS, Pa.

"We submit the possibility that some of these shortages may be artificial, and that the shutdowns may be due to arbitrary price-fixing rather than genuine shortage." —ALLOY STEEL SPECIALTIES MAKER, Pa.

"Our production has been reduced by reduced automobile production partly on account of government restrictions and partly due to customers' lack of certain materials." — AUTOMOBILE PARTS MAKER, N. Y.

"We have had no percentage loss so far. Warehouse steel at a big cost increase has been used entirely." — MANUFACTURER OF LIGHT STRUCTURAL STEELS, Maine.

(Complete returns in THE IRON AGE Priorities Poll will be published in the Nov. 6 issue.)

Photo by British Combine

DOWNED 200 PLANES: One British A.A. brigade has shot down more than 200 German planes since the beginning of the war, according to information passed by the British censor. One of the anti-aircraft guns used by this brigade is shown above.

Priority Setup Found Defeating Itself

Pittsburgh

• • • **Orders with** priority ratings constitute such a large percentage of current shipments that steel officials find ratings are nullifying themselves with greater regularity. Complaints of slow deliveries are reaching mills in greater number. The answer is always the same, higher ratings held back the material in question.

The average amount of steel per order has gone up from about 47 tons per order to 76 tons per order in the past few months. This indicates, it is said, that many of the smaller customers are forced to go to warehouses or else are out of the market for the time being, owing to discouraging delivery promises.

Indiana Ordnance Plant Hits Its Full Stride

Charlestown, Ind.

• • • **Full production** was attained at the $114,000,000. Indiana Ordnance works here when the last of its six manufacturing lines hit its stride last week. Full production is at the rate of 600,000 lb. of smokeless powder a day.

Cincinnati Group Plans Cooperative Subcontracting

Cincinnati

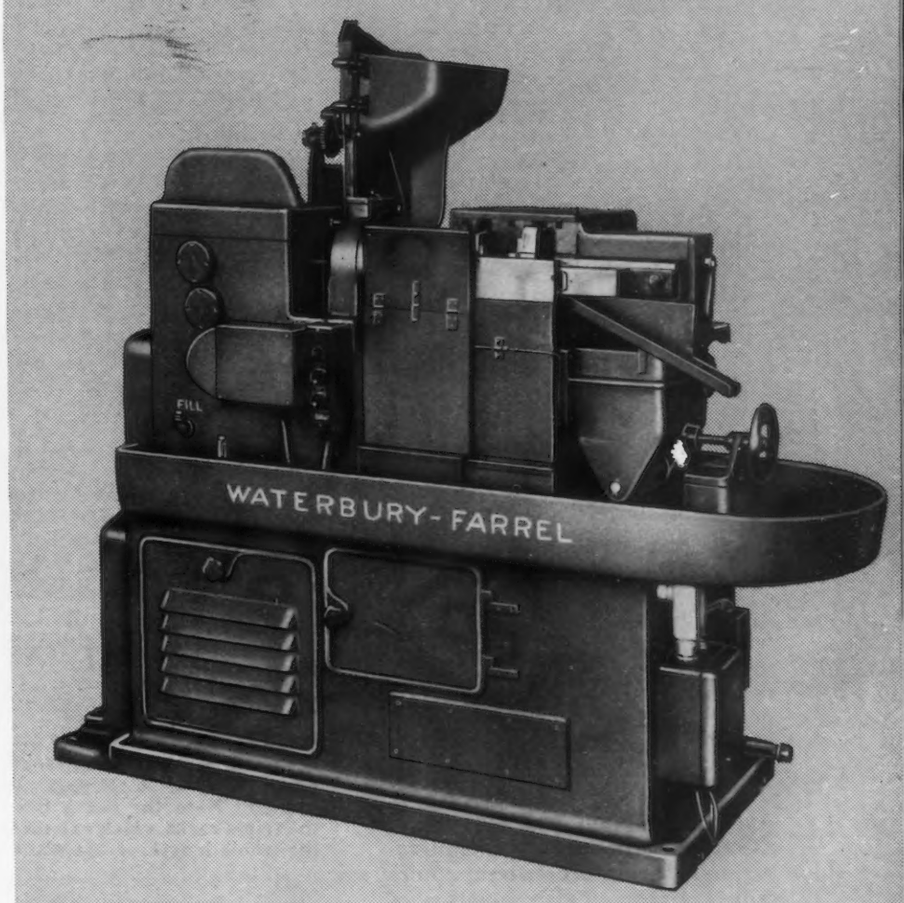
• • • **A number of** tool and die manufacturers in this area met with officials of the Savage Arms Co. last week under the sponsorship of OPM in an effort to obtain subcontract work for the manufacture of machine gun components. It is planned to have one of the companies accept an order and parcel the work among other participating subcontractors.

Wheeling Steel Corp. Orders 16 Coal Barges

East Liverpool, Ohio

• • • **Wheeling Steel Corp.** has ordered sixteen coal barges from the Dravo Corp. for use on the Ohio and Allegheny Rivers. They will be 200 feet long, 26 feet wide, 10 feet deep.

Precision Nut Tapping at High Speeds



STATIONARY STRAIGHT SHANK TAPS

AUTOMATIC NUT TAPPING MACHINES

A revolutionary design featuring the use of **straight shank taps.** Three sizes with tap sizes as follows:

No. 1 — 1/4" to 7/16" No. 2 — 3/8" to 9/16" No. 3 — 1/2" to 7/8"

Production depends chiefly on these factors—

(1) Size of Nut
(2) Speed of Tap
(3) Material of Nut
(4) Class of Fit

Send for Circular No. 914-A—there's no obligation.

WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

WATERBURY, CONNECTICUT

CLEVELAND CHICAGO NEWARK, N. J.

Westinghouse in Ohio Gets Big Shell Order

• • • **The Mansfield** plant of Westinghouse Electric & Mfg. Co. will receive a $2,750,000 U. S. Army contract for 37-mm. armor-piercing shells, B. W. Clark, Westinghouse vice-president, announced Notification of the award was received from Army Ordnance Headquarters in Cleveland.

The contract will provide employment for several hundred persons, and machinery and other equipment necessary for this work will be ordered immediately. Production should be started shortly after the first of the year.

The shells, which are approximately one and one-half inches in diameter and six and one-half inches long, are particularly effective in anti-tank warfare. Known technically as three-piece shot, they have a forged steel body with an alloy steel penetrating point or cap, and an aluminum "windshield" which cuts down wind resistance.

Westinghouse officials some months ago spent $75,000 to prepare a section of the Mansfield plant to handle work of this type, and the new contract will be their second major defense project. In August the plant was awarded a $3,173,000 order for the manufacturing of army binoculars. More than half the total production of Westinghouse plants throughout the country is devoted to defense work.

More Lease Agreements By Defense Plant Corp.

Washington

• • • **The Defense Plant Corp.** has entered into the following lease agreements for the War Department and the Maritime Commission:

Extruded Metals Defense Corp., Grand Rapids, Mich., (for War Department) $6,266,000 to $6,615,761 for additional facilities for plant at Belding, Mich.; manufacture of extruded aluminum alloys.

Bendix Aviation Corp. (Scintilla Magneto division), (War Department) $2,550,000 to $3,195,308 for additional facilities for plant at Sidney, N. Y.; production of aircraft equipment.

Clarke Aero-Hydraulics, Inc., Pasadena, Cal., (War Department) $87,535.20 for equipment.

Holley Carburetor Co., Detroit, (War Department) $661,415 to $760,123 for additional facilities; manufacture of aircraft equipment.

Barnes-Duluth Shipbuilding Co., Duluth, Minn., (Maritime Commission) $280,000 in connection with building cargo boats.

1940 By-Products Yield Set at $160 Million

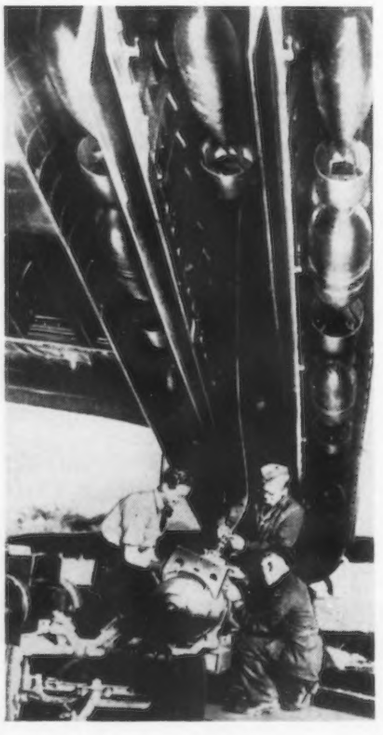
• • • **By-products** valued at approximately $160,000,000 were produced by the steel industry in 1940 in the manufacture of coke from coal, according to the American Iron & Steel Institute.

The most important by-product last year was approximately 638 billion cubic feet of gas, valued at close to $98,900,000. Over 515 million gallons of tar, valued at nearly $23,700,000 were recovered from by-product coke ovens. Nearly 165 million gallons of light crude oil was produced, of which nearly 8 million gallons, valued at over $600,000, were sold. The rest of the light oil was refined in the industry's by-product plants into benzol, toluol, which is used in explosives, naphtha and other chemical. Total value of these was nearly $16,500,000.

Among other chemical by-products recovered from the coking process were about $14,500,000 worth of ammonium sulphate and ammonia liquor.

STIRLING BOMB RACK: This photo is said to be the first closeup of the bomb rack of a British Stirling bomber. Note the heavy bombs on the triple racks which extend almost the whole length of the plane.

Photo by British Combine.



$20 Million Ordnance Plant Dedicated by Navy

Detroit

• • • **A $20,000,000 naval** ordnance plant operated by Hudson Motor Car Co., at Centerline, near Detroit, was dedicated Tuesday by Frank Knox, Secretary of the Navy, following an inspection by the Secretary and other Navy officials. In accepting the new naval plant for the Bureau of Ordnance, Rear Admiral W. H. P. Blandy, chief of the Bureau of Ordnance, declared that the plant has become a permanent part of the national defense set-up.

The plant site is 135 acres at Nine Mile Road and Mound Road on which 14 buildings, containing over 1,000,000 sq. ft. of floor space have been erected in seven months. The construction is 95 per cent completed and production has already started on the Oerlikon 20 mm. anti-aircraft gun to arm merchant ships and navy vessels against dive bomber attacks. The plant will employ 7000 workers. About 200,000 sq. ft. of the floor space will be devoted to the Oerlikon gun manufacture, producing an undisclosed number of the 600 parts in the gun. Parts produced in outside plants will be delivered to this plant for final assembly.

In addition, the plant will produce an unannounced variety of naval ordnance components including fire control and direction apparatus, parts for gun mounts, torpedo tubes and catapult guns.

This plant will be one of a string of five located west of the Appalachian mountains now being put into operation as permanent sources of supply for armament of American ships.

Plane and Parts Exports 35% of Total Production

Washington

• • • **Commerce Department** reports show that exports of aeronautical products during August totaled $52,331,213, or about 35 per cent of the total estimated production. This total, representing an increase of $9,386,000 over July, was the third highest month in the industry's history. Exports in April and May this year aggregated $66,000,000 and $54,000,000 respectively.

Cars De-glamourized In New OPM Order

Washington

• • • **Automobiles will lose some of their glitter after Dec. 15, according to an order issued Oct. 27 by OPM. The order, entitled Supplementary General Limitation Order L-2-b prohibits the use of bright finish, bright work, metal finish or body trim containing aluminum, copper, nickel or chrome, except in cases where special permission is granted for bumpers. The order does not specify what constitutes bright finish, bright work, etc.**

Permission may be granted, according to OPM, to use the restricted materials in plating bumpers and bumper guard assemblies, provided evidence is submitted to OPM showing that all possible conservation measures have been utilized and that usage will be held to "minimum practicable quantities."

Airco Lists Products, Activities in New Booklet

• • • **A detailed** description of the activities of the five companies which comprise Air Reduction Co., Inc., illustrated both with pictures and diagrams and completely describing the methods, the markets and the nature of the business, was made available to all stockholders of the company recently.

The purpose of the book is to acquaint stockholders and others, who in many cases are actually unaware of the very nature of the company's business in spite of substantial holdings, of what Air Reduction does, and give a full and complete description of the thousands of uses to which the company's products are put.

Because Air Reduction today has almost two and one-half times as many stockholders as it has employees—although these latter number over 6100—it was felt that the company should explain this and many other important aspects of its business such as that it is a major producer of oxygen, nitrogen, hydrogen, acetylene, calcium carbide, carbon dioxide, helium, neon, arc welding machines and equipment.

IRON AGE DATA ON

SELLING TO THE ARMY

Where and How War Department Buys Metal Products

• • • Last week the War Department's Quartermaster Corps announced that prices will no longer be the dominating factor in making awards. This means that small plants and plants in unfavorable geographical positions will now have a good chance to get Army business. The new War Department policy to aid small business will seek to spread defense orders in as many regions and to as many suppliers in each region as is possible, and will aim to award the orders at a fair price to the producer, even though a more advantageously situated producer is supplying the same material more cheaply. When informal bid prices are considered too high, the War Department will negotiate with bidders.

Plants outside of concentrated industrial centers, plants in danger of closing down, plants at present unfamiliar with and inadequately equipped to produce items the Army wants, now have an opportunity to obtain the business they want and need.—The Iron Age.

• • •

MOST Army purchases are made by purchasing agencies (depots and arsenals) of the various Army corps and departments. Some are made by Army posts and stations. A few are made by the Treasury Department. Which offices purchase which items, and what steps you should take to obtain orders, are given below for each of these types of purchases.

I—Selling to Army Purchasing Agencies

1. Most purchases of articles in ordinary commercial production are made after the Army has advertised for bids. To receive Army invitations to bid, you should write directly to the particular agencies which buy articles you can supply. A reference list of items and agencies is given below. When these agencies are ready to buy the types of articles you produce, you will then receive from them the invitation to bid, and a questionnaire. Awards will not be made to firms whose questionnaires show that, in order to carry out the contract, they will need (a) more than 10 per cent new tools or equipment, (b) new plant construction costing more than $20,000.

2. Articles in ordinary commercial production are also bought by the Army without public bidding, if the Army considers that circumstances warrant it. This is being done, increasingly. The considerations to which the Army gives weight are those of the company's need for business, prompt delivery, proper quality, fairness of price, effect of the defense program on consumers, maintenance of fair labor standards, avoidance of geographic concentration of contracts and congestion of transportation, moral and financial responsibility of prospective contractors, and availability of power facilities. To make sales of this sort, write to the agencies purchasing the type of articles you wish to sell, describe the articles you are equipped to produce, the quantities in which you can produce them, and your general situation.

3. Articles not in ordinary commercial production, such as weapons, ammunitions, and special transportation and communication equipment, are often bought by the Army without public bidding. To make sales of this sort, follow the same procedure as in (2), writing to the proper purchasing agency.

List of Articles Purchased

(Agencies referred to by number are listed following Articles Index)

Article	Reference No. Purchasing Agency
Adding machines	6
Agricultural implements	4
Air-brake equipment	21
Aircraft communications equipment	18
Airplanes	14
Airplane accessories	14
Airplane equipment	14
Airplane parts	14
Aluminum and alloys	11-12
Animal drawn vehicles	4
Apparatus, fire fighting	8
Appliances, surgical	22-23
Arches, corrugated steel	21
Automobiles	8
Automotive equipment,	11-12-13
Badges	1
Bakery equipment	4
Balances, sensitive	11
Bars	11
Bedsteads, barrack	5
Bicycles	8
Boats, harbor	10
Boilers	21
Brass	11-12
Bridges, steel	21
Bronze	11-12
Camouflage equipment	21
Cars, railroad	21
Cartridge brass	11
Cases, filing	6
Castings	11-12
Chemicals, industrial	11
Chemical plant equipment	15
Copper	11-12
Cots, steel	5
Cranes	21
Dental equipment	21
Dental instruments	22
Desks, field	5
Devices, office, labor saving	6
Diagnostic instruments	22
Dies	11-12
Drafting equipment	21
Dredges	21
Engines, electric	21
Engines, gasoline	21
Electric plating equipment	12
Field equipment	22
Field stoves	4
Filing cases	6
Fire fighting apparatus	8
Fixtures	12
Flying equipment	14
Flying supplies	14
Forgings	11

Article	Reference No. Purchasing Agency
Furnaces, heat treating,	11-12
Furniture, office, officers' and noncommissioned officers'	6
Gages	11-12
Garage equipment	8
Gas Masks	15
Grinders	11-12
Hand tools	21
Heavy machinery	21
Hoists	21
Hospital furniture	23
Hydraulic presses	21
Iron	11-12
Jacks	21
Jigs	11-12
Kitchen equipment	4
Lathes	11-12
Lighting equipment	14
Locomotives	21
Machines	11-12-15
Machine tools	8-11-12-15
Machinery for motor repair shop	8
Metals	1
Metal components	11-12-15
Meteorological equipment	16
Molded rubber	15
Optical instruments	12
Pack equipment	4
Photo-engraving equipment	21
Photographic equipment,	16-20-21
Plastics	15
Plates	11
Power shovels	21
Radio communication equipment	16
Radio equipment	19
Rail transportation	9
Ranges	4
Ranges, electric and gas	6
Refrigerators	6
Rods	11
Roofing	11-12-13
Sawmills	21
Scales, postal	6
Scales, weighing	5-11
Shapers	11-12
Shapes	11-12
Stampings	11
Steel	11-12
Steel bridges	21
Steel construction	11-12-13
Storage tanks	21
Strapping, metal	11-12
Submarine mine equipment and supplies	24
Surgical equipment and instruments	22
Telegraph equipment	17
Telephone equipment	17
Tools, hand	8
Tools, machine	8
Trailers	8
Transformers	21
Trucks, cover	8
Trucks, motor	8
Typewriters	6
Vessels, marine	10
Wire	11
Wire and cable	16-17
Woodworking machinery	11-12

Purchasing Agencies

QUARTERMASTER CORPS

1—Philadelphia Quartermaster Depot
21st and Johnston Streets
Philadelphia

4—Jeffersonville Quartermaster Depot
10th Street and Meigs Avenue
Jeffersonville, Ind.

5—Chicago Quartermaster Depot
1819 West Pershing Road
Chicago

6—Washington Quartermaster Depot
24th and M Streets, N. W.
Washington

8—Holabird Quartermaster Depot
Camp Holabird
Baltimore

1, 2, 3, 4, 5, 6, 7, & 8—Fourth Corps Area Quartermaster Depot, Atlanta

Seattle Quartermaster Depot
312 Federal Office Bldg.
First Avenue and Madison Street, Seattle

Quartermaster Section
San Antonio General Depot
Fort Sam Houston, Texas

Quartermaster
Second and Arsenal Streets
St. Louis

Philippine Quartermaster Depot
Manila, P. I.

Puerto Rican General Depot
Fort Buchanan, P. R.

Hawaiian Quartermaster Depot
Honolulu

Quartermaster Section
Panama-Pacific General Depot
Corozal, C. Z.

Quartermaster Section
Panama-Atlantic General Depot
Fort William D. Davis, C. Z.

10—Transportation Division (Water Transport)

Office of Quartermaster General
Washington

ORDNANCE DEPARTMENT

11—Frankford Arsenal
Philadelphia

Picatinny Arsenal
Dover, N. J.

12—Rock Island Arsenal
Rock Island, Ill.

Watertown Arsenal
Watertown, Mass.

Watervliet Arsenal
Watervliet, N. Y.

Springfield Armory
Springfield, Mass.

13—Aberdeen Proving Ground
Maryland

Augusta Arsenal
Augusta, Ga.

Benicia Arsenal
Benicia, Cal.

Charleston Ordnance Depot
Charleston, S. C.

Curtis Bay Ordnance Depot
Curtis Bay, Md.

Delaware Ordnance Depot
Pedricktown, N. J.

Erie Ordnance Depot
LaCarne, Ohio

Hawaiian Ordnance Depot
Honolulu, T. H.

Nansemond Ordnance Depot
Portsmouth, Va.

Ogden Ordnance Depot
Ogden, Utah

Raritan Arsenal
Metuchen, N. J.

San Antonio Arsenal
San Antonio, Texas

Savanna Ordnance Depot
Savanna, Ill.

Wingate Ordnance Depot
Fort Wingate, N. M.

AIR CORPS

14—Materiel Division
Air Corps
Wright Field
Dayton, Ohio

CHEMICAL WARFARE SERVICE

15—Edgewood Arsenal
Edgewood, Md.

Boston C. W. Procurement District
2000 U. S. Post Office Building
Boston

New York C. W. Procurement District
45 Broadway
New York

Pittsburgh C. W. Procurement District
1044 New Federal Building
Pittburgh

Chicago C. W. Procurement District
1113 New Post Office Building
Chicago

SIGNAL CORPS

16—Signal Section
New York General Depot
Brooklyn

Army Signal Corps Procurement District
First Avenue and 58th Street
Brooklyn

17—Signal Section
Chicago Quartermaster Depot
Chicago

Army Signal Corps Procurement District
1819 West Pershing Road
Chicago

18—Aircraft Radio Laboratory
Wright Field
Dayton, Ohio

19—Signal Corps Laboratory
Fort Monmouth, N. J.

CORPS OF ENGINEERS

21—Contracting Officer
Office of the Chief of Engineers
First and M Streets, N. W.
Washington

Also, to a limited extent, the following:

The Department Engineer, at:

Hawaiian Department, Headquarters,
Ft. Shafter, T. H.

Panama Canal Department
Corozal, C. Z.

Philippine Department
Ft. Santiago, Manila, P. I.

Puerto Rican Department
San Juan, P. R.

The Engineer, at:

First Corps Area, Army Base
Boston 9

Second Corps Area
Governors Island, N. Y.

Third Corps Area, U.S.P.O. & Court House
Baltimore

Fourth Corps Area, Old P. O. Building
Atlanta

Fifth Corps Area, Ft. Hayes
Columbus, Ohio

Sixth Corps Area
1300 New P.O. Building
Chicago

Seventh Corps Area,
Federal Building, 15th & Dodge Streets
Omaha, Neb.

Eighth Corps Area
Fort Sam Houston, Texas

Ninth Corps Area,
Presidio of San Francisco

II Corps
Fort Jay, N. Y.

IV Corps
Fort Benning, Ga.

VI Corps
Fort Sheridan, Ill.

IX Corps
Fort Lewis, Wash.

I Armored Corps
Fort Knox, Ky.

GHQ Air Force
Langley Field, Va.

The Commandant, at:

Engineer School
Fort Belvoir, Va.

The Officer In Charge, at:

Engineer Reproduction Plant

Army War College
Washington

Engineer Supply Officer, Engineer Section, at:

Columbus General Depot
Columbus, Ohio

San Antonia General Depot
Fort Sam Houston, Texas

Hawaiian Engineer Depot
Schofield Barracks, T. H.

New York General Depot
58th Street & First Avenue
Brooklyn

Panama-Pacific General Depot
Corozal, C. Z.

Philippine Engineer Depot
Port Area, Manila, P. I.

San Francisco General Depot
Fort Mason, San Francisco

Schenectady General Depot
Schenectady

Puerto Rican General Depot
Fort Buchanan, San Juan, P. R.

The Chief, at:

Chicago Procurement District
U.S. Engineer Office
1117 New Post Office Building
Chicago

New York Procurement District
U.S. Engineer Office
710 Army Building, 39 Whitehall Street
New York

Philadelphia Procurement District
U.S. Engineer Office
900 Customhouse, 2nd and Chestnut Streets
Philadelphia

Pittsburgh Procurement District
U.S. Engineer Office
1012 New Federal Building
Pittsburgh

San Francisco Procurement District
U.S. Engineer Office
401 Customhouse
San Francisco

Birmingham Procurement District
U.S. Engineer Office
212 Wilson Building
Mobile, Ala.

Engineer Board
Fort Belvoir, Va.

MEDICAL CORPS

22—Medical Section
New York General Depot
First Avenue and 58th Street
Brooklyn

COAST ARTILLERY CORPS

24—Submarine Depot
Fort Monroe, Va.

II—Selling To Army Posts and Stations:

A list of principal army posts and stations is given below. To sell to any of these posts, communicate directly with the officer in whose activities you are interested. Purchases by these posts are not restricted to the immediate vicinity of the post, but are made, without regard to locality, from the source offering the best advantage to the government.

Articles purchased by posts and stations are usually materials for operation and maintenance of utilities, for maintenance and repairs of equipment, or for minor construction projects, special or emergency articles, and perishable subsistence items.

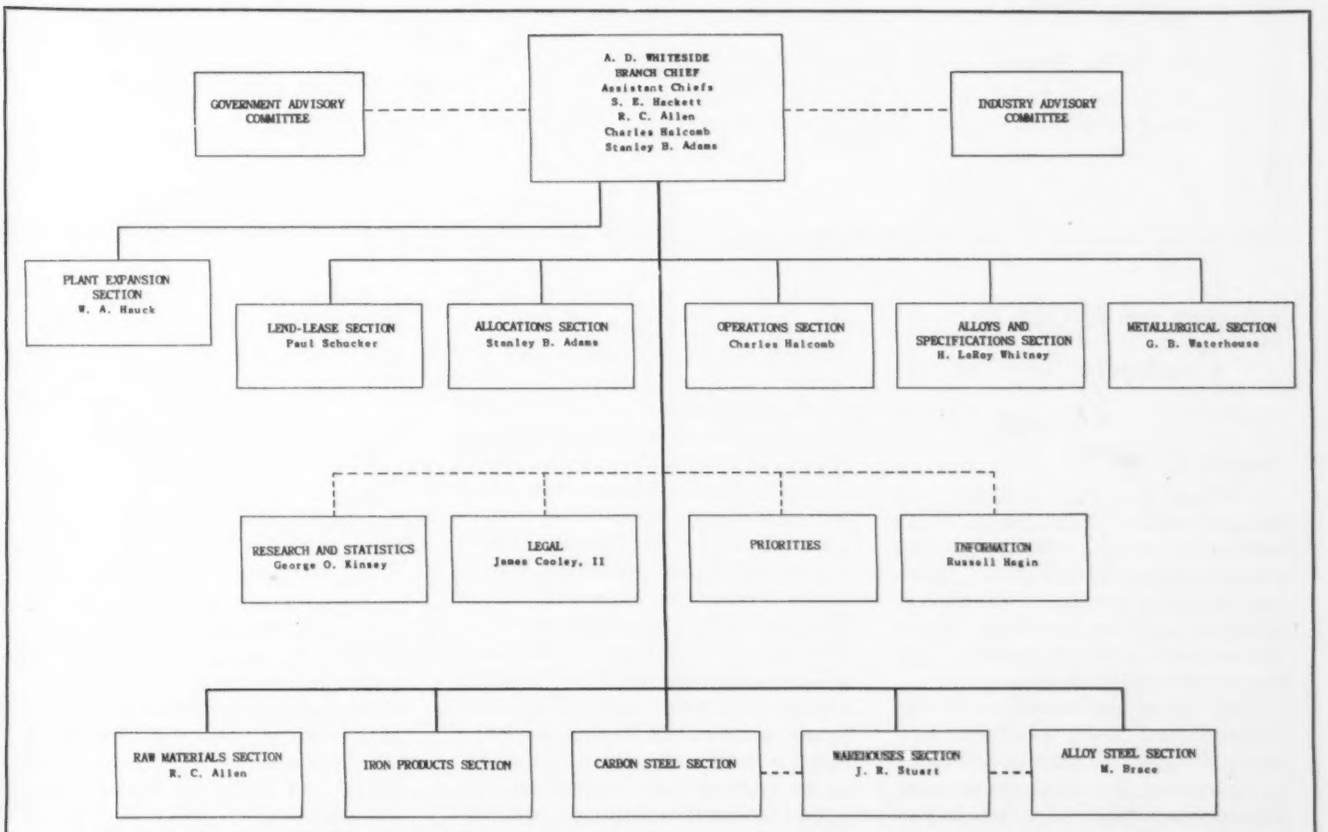
PRINCIPAL ARMY POSTS AND STATIONS

Aberdeen Proving Ground, Md.
Fort Adams, R. I.
Albrook Field, C. Z.
Fort Ethan Allen, Vt.
Fort Amador, C. Z.
Fort Andrews, Mass.
Army Medical Center, Washington
Army Motor Center, Washington
Army War College, Washington
Army and Navy General Hospital, Hot Springs, Ark.
Augusta Arsenal, Augusta, Ga.
Fort Baker, Cal.
Harbor Defense Fort Banks, Mass.
Camp Barkeley, Abilene, Tex.
Barksdale Field, La.
Fort Barrancas, Fla.
Fort Barry, Fort Baker, Cal.
William Beaumont General Hospital, El Paso, Texas
Fort Belvoir, Va.
Benicia Arsenal, Benicia, Cal.
Fort Benning, Ga.
Camp Blanding, Starke, Fla.
Fort Bliss, Texas
Bolling Field, D. C.
Camp Bonneville, Ore.
Borinquen Field, P. R.
Corps Area Motor Repair Shop, Army Base, Boston
Camp Bowie, Brownwood, Tex.
Bowman Field, Louisville, Ky.
Camp Boyd, Fort Bliss, Tex.
Fort Brady, Mich.
Fort Bragg, N. C.
Brooklyn Army Base, 58th Street & First Avenue, Brooklyn
Fort Brown, Tex.
Camp Bullis, San Antonio, Tex.
Camp Callan, San Diego, Cal.
Fort Canby, Illwaco, Wash.
Carlisle Barracks, Pa.
Fort Casey, Coupeville, Wash.
Chanute Field, Rantoul, Ill.
Chapman Field, Miami, Fla.
Chilkoot Barracks, Alaska.
Fort Church, Sakonnet Point Military Reservation, Little Compton, R. I.
Camp Claiborne, Alexandria, La.
Camp Clatsop, Ore.
Fort Clark, Tex.
Fort Clayton, C. Z.
Fort Columbia, McGowan, Wash.
Fort Constitution, New Castle, N. H.
Post of Corozal, C. Z.
Crissy Field, Presidio of San Francisco
Fort Crockett, Tex.
Camp Croft, Spartanburg, S. C.
Fort Crook, Neb.
Fort Cronkhite, Fort Baker, Cal.
Camp Custer, Mich.
Camp Davis, Hollyridge, N. C.
Fort William D. Davis, C. Z.
Fort Dawes, Deer Island, Mass.
Fort Delaware, Delaware City, Del.
Delaware Ordnance Depot, Pedricktown, N. J.
Fort Delesseps, C. Z.
Fort Des Moines, Iowa
Fort Devens, Mass.
Fort Dix, N. J.
Camp Dodge, Herrold, Iowa
Fort Douglas, Utah
Fort Dupont, Del.
Fort Duvall, Winthrop Station, Boston
Edgewood Arsenal, Edgewood, Md.
Camp Edwards, Falmouth, Mass.
Erie Ordnance Depot, La-Carne, Ohio
Fort Eustis, Va.
Fishermen's Island, Kiptopeke, Va.
Fitzsimmons General Hospital, Denver
Fort Flagler, Port Townsend, Wash.
Camp Forrest, Tullahoma, Tenn.
Fort Foster, Kitterv, Me.
France Field, Canal Zone
Front Royal, Va.
Fort Funston, Fort Winfield Scott, San Francisco
Fort Getty, Jamestown, R. I.
Camp Grant, Rockford, Ill.
Fort Greble, Jamestown, R. I.
Fort Nathaniel Greene, Narragansett, R. I.
Camp Haan, Riverside, Cal.
Hamilton Field, Cal.
Fort Hamilton, N. Y.
Fort Hancock, N. Y.
Fort Benjamin Harrison, Ind.
Camp John Hay, P. I.
Fort Hayes, Columbus, Ohio
Fort Heath, Winthrop Sta., Boston
Hensley Field, Grand Prairie, Tex.
Hickman Field, T. H.
Fort Sam Houston, Tex.
Fort Howard, Md.
Fort Huachuca. Ariz.
Camp Hulen. Palacios, Tex.
Fort Hunt, Va.
Hunter Liggett Military Reservation, Jolon, Cal.
Indiantown Gap Military Reservation, R. R. 2, Jonestown, Pa.
Fort Philip Kearney, Saunderstown, R. I.
Fort Jay, Governors Island, N. Y.
Jefferson Barracks, Mo.
Fort Kamehameha, T. H.
Kelly Field, Tex.
Ketchikan, Alaska
Key West Barracks, Fla.
Fort Knox, Ky.
Langley Field, Va.
Fort Lawton, Wash.
Fort Leavenworth, Kan.
Camp Lee, Va.
Letterman General Hospital, San Francisco
Fort Levett, Portland, Me.
Fort Lewis, Wash.
Fort Lincoln, N. D.
Little Falls, Minn.
Camp Livingston, Alexandria, La.
Fort Logan, Colorado
Lowry Field, Denver
Luke Field, T. H.
Lunken Airport, Cincinnati
MacDill Field, Tampa, Fla.
Fort MacArthur, Cal.
McChord Field, Wash.
Fort McClellan, Ala.
McClellan Field, Sacramento, Cal.
Camp McCoy, Wis.
Fort McDowell, Cal.
Fort McIntosh, Tex.
Fort McKinley, Portland, Me.
Fort McPherson, Ga.
Camp McQuaide, Watsonville, Cal.
Fort McRae, Fort Barrancas, Fla.
Madison Barracks, N. Y.
March Field, Cal.
Fort Mason, Cal.
Maxwell Field, Ala.
Fort Meade, S. D.
Fort Geo. C. Meade, Md.
Fort Michle, New London, Conn.
Middletown Air Depot, Middletown, Pa.
Fort Miley, San Francisco
Fort Mills, Corregidor, P. I.
Fort Missoula, Mont.
Mitchell Field, N. Y.
Moffett Field, Cal.
Fort Monmouth, N. J.
Fort Monroe, Va.
Fort Mott, Salem, N. J.
Fort Moultrie, S. C.
Camp Murray, Wash.
Fort Myer, Va.
Nansemond Ordnance Depot, Portsmouth, Va.
New Cumberland General Depot, New Cumberland, Pa.
New Orleans Quartermaster Depot, New Orleans
New York Port of Embarkation, Brooklyn
Fort Niagara, N. Y.
Normoyle Quartermaster Depot, San Antonio, Tex.
Fort Oglethorpe, Ga.
Fort Omaha, Neb.
Fort Ontario. N. Y.
Fort Ord, Cal.
Orlando Air Base, Orlando, Fla.

Patterson Field, Fairfield, Ohio
Camp Pendleton, Virginia Beach, Va.
Pettit Barracks, P. I.
Philippine Air Depot, Nichols Field, Rizal, P. I.
Picatinny Arsenal, Dover, N. J.
Fort Pickens, Fort Barrancas, Fla.
Pine Camp, Great Bend, N. Y.
Plattsburg Barracks, N. Y.
Camp Polk, Leesville, La.
Pope Field, Fort Bragg, N. C.
Port Columbus, Columbus, Ohio.
Fort Preble, Portland, Me.
Presidio of Monterey, Cal.
Presidio of San Francisco
Port of Quarry Heights, Canal Zone.
Randolph Field, Tex.
Fort Randolph, C. Z.
Raritan Arsenal, Metuchen, N. J.
Fort Reno, Fort Reno, via El Reno, Okla.
Fort Revere, Hull, Mass.
Fort Riley, Kan.
Fort Ringgold, Tex.
Camp Roberts, San Miguel, Cal.
Fort Robinson, Neb.
Camp Joseph T. Robinson, Ark.
Rock Island Arsenal, Ill.
Fort Rodman, New Bedford, Mass.
Fort Rosecrans, Cal.
Fort Ruckman, Winthrop Sta., Boston
Fort D. A. Russell, Tex.
Fort Ruger, T. H.
Sacramento Air Depot, Sacramento, Cal.
San Antonio Air Depot, Duncan Field, Tex.
San Francisco Port of Embarkation, Fort Mason, San Francisco
Fort San Jacinto, Galveston, Tex.
Post of San Juan, P. R.
Camp San Luis Obispo, Cal.
Fort Saulsburg, Milford, Del.
Savanna Ordnance Depot, Savanna, Ill.
Schofield Barracks, T. H.
Scott Field, Belleville, Ill.
Harbor Defenses, Fort Winfield Scott, Cal.
Fort Screven, Ga.
Camp Seeley, Cal.
Selfridge Field, Mich.
Fort Shafter, T. H.
Camp Shelby, Miss.
Fort Sheridan, Ill.
Fort Sherman, C. Z.
Camp Sibert, Boulder City, Nev.
Fort Sill, Okla.
Camp Skeel, Oscoda, Mich.
Fort Slocum, N. Y.
Fort Snelling, Minn.
Springfield Armory, Springfield, Mass.
Fort Standish, Boston
Camp Stanley, San Antonio, Tex.
Fort Stark, Portsmouth, N. H.
Fort Stevens, Ore.
Fort Story, Cape Henry, Va.
Fort Stotsenburg, Pampanga, P. I.
Fort Strong, Boston
Fort Sumter Moultrieville, S. C.
Fort Taylor, Key West, Fla.
Fort Terry, New London, Conn.
Fort Thomas, Ky.
Fort Tilden, Rockaway Park, L. I.
Camp Toombs, Toccoa, Ga.
Fort Totten, N. Y.
Fort Townsend, Port Townsend, Wash.
Fort Travis, Galveston, Tex.
Tripler General Hospital, Honolulu
Camp Upton, Yaphank, N. Y.
Vancouver Barracks, Wash.
Fort Wadsworth, N. Y.
Camp Wallace, Hitchcock, Tex.
Fort Warren, Boston
Fort Francis E. Warren, Wyo.
Watertown Arsenal, Watertown, Mass.
Fort Washington, Md.
Fort Wayne, Detroit
Fort Weatherill, Jamestown, R. I.
U. S. Military Academy, West Point, N. Y.
Westover Field, Chicopee Falls, Mass.
Wheeler Field, T. H.
Fort Whitman, La Conner, Wash.
Fort Williams, Me.
Camp Wolters, Mineral Wells, Tex.
Fort Wood, N. Y.
Fort Leonard Wood, Rolla, Mo.
Fort Wool, Fort Monroe, Va.
Fort Worden, Wash.
Wright Field, Dayton, Ohio
Fort George Wright, Wash.
Fort H. G. Wright, N. Y.

III—Selling To The Army Through The Treasury Department

The Army buys some of its office furniture, filing cases and tires and tubes through the Procurement Division of the Treasury Department. To make this sort of sale, address Procurement Division, Treasury Department, Washington, and you will receive the division's invitation to bid. (The Treasury Department's Procurement Division is the central purchasing agency for the government, although the Army is in general exempt from participating in its contracts.)



OPM IRON AND STEEL BRANCH: The above chart shows the present organization of the Iron and Steel Branch of the Office of Production Management. (Division of Materiel.)

Subcontracting Opportunities

(On Oct. 23 the Contract Distribution Division of OPM made public an Army compliation of existing contracts which seem to offer the greatest subcontracting opportunities. Field officers of the Contract Distribution Division of OPM have copies of the list and will be glad to advise prospective subcontractors on procedure. The list is known as PM-1417.—The Iron Age)

TYPE OF EQUIPMENT	CONTRACTORS	ADDITIONAL DETAILS
20 mm. Aircraft Cannon...	Bendix Aviation (Eclipse Machine) Elmira, N. Y. Munitions Mfg. Co. (IBM) Poughkeepsie, N. Y. Olds Motor Division of General Motors Corp., Lansing, Mich. International Harvester Co., Minneapolis, Minn.	
37 mm. Gun Carriage M4..	York Safe & Lock Co., York, Pa. Duplex Printing Press Co., Battle Creek, Mich. Muncie Gear Works, Muncie, Ind.	
Periscope, M1 & M2.....	Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.	
Pedestal, Mount, M24.....	Trackson Co., Milwaukee, Wis.....	
Mount, Telescope, M23....	Builders Iron Foundry, Providence, R. I.	
Carriage, How., 105 mm. M2	American Locomotive Co., Dunkirk, N. Y.	
Mount, Machine Gun, 50 Cal. AA M2	Butterworth Co., Philadelphia, Pa.	
Field Ranges, M-1937	Wm. R. Boots. Successor, Crescent Stove Works, Evansville, Ind.	Contract W-431 QM-5554; Amount $184,305; Straps, Panels, Shields, Burners, Bodies, Chambers, Caps, Screws, Rivets, etc., etc.
Folding Steel Cots	Simmons Co., New York City.....	Contract W-199 QM-21102; Amount $361,900.
Diesel Cranes	Osgood Co., Marion, Ohio	Contract W-1311 QM-177; Amount $115,400: Type 80, Model 805.
Crawler Cranes No. 307....	General Excavator Co., Marion, Ohio..	Contract W-1311 QM-178.
Boat Engines (600 hp.) ...	Hall Scott Motor Co., Newark, N. J...	Contract W-1311 QM-187; Amount $465,654; for 100-ft. rescue boats.
Retrieving Vessels	Sturgeon Bay S.B. and D.D. Co., Sturgeon Bay, Wis.	Contract W-1311 QM-142; Amount $1,215,000: for 150-ft. vessels (Air Corps Allotment)
Steel Barges (all welded)..	Equitable Equipment Co., New Oleans, La.	Contract W-1311 QM-154; Amount $266,400; 120-ft. barges.

Closing of 1800 Contracts Seen at Chicago Clinic

Chicago

• • • **The eventual closing** of around 1800 subcontracts was sighted here last week at the Defense Production Clinic, which attracted close to 10,000 seekers of defense contracts from eight states and 175 of the nation's leading prime contractors.

This was a businesslike clinic—far different from the one held here about two months ago. Wright Aeronautical, Studebaker, General Motors, Caterpillar Tractor, Glenn L. Martin, Westinghouse, General Electric, Crane Co., Allis-Chalmers, Pratt & Whitney, Link-Belt, Rolls-Royce, Pullman-Standard, International Harvester were among the prime contractors and all branches of the armed services were represented.

After two days of interviews, Pullman-Standard reported that 50 per cent of its contacts were adequately equipped to handle their subcontracting. International Harvester said that six out of 125 were able to meet its close tolerances. General Motors reported satisfaction with 15 per cent of 200 interviewed. Armstrong Bros. Tool Co. reported great progress. Northern pump announced it would award contracts to about three out of 25. In two days the Bettendorf Co. found enough outlets to take all the work to be released. This also happened to Oilgear Co. and several others.

Among highlights of the clinic was formation of a pool of furnace manufacturers from Dowagiac, Mich., to obtain a one million dollar order for powder cans and furnaces for military housing.

In 10 minutes at the booth of a pipe wrench manufacturer, three small businessmen came along. One couldn't handle the forgings, another didn't have screw machines. But the third had plenty of screw machines, picked up two parts, said he could do them and showed his list of equipment. A date was made right there.

The big fellows tried to make it as easy as possible for the "shoppers." Western Cartridge Co. displayed the complete manufacturing process of .30 and .50 cal. cartridges from blank and cup to inspection, plus a complete layout of the tools required.

TYPE OF EQUIPMENT	CONTRACTORS	ADDITIONAL DETAILS
	Allen Boat Co., Harvey, La.	Contract W-1311 QM-191; Amount $130,000; 120-ft. barges.
Steel Cargo Barges	Ingalls Shipbuilding Co., Birmingham, Ala.	Contract W-1311 QM-147; Amount $510,240; 210-ft. barges.
Trucks, ½ ton 4 x 4	Fargo Motor Corp., Detroit, Mich.	Contract 10327; Amount $2,809,561; Model T-215; weapon carrier, etc.
Trucks, 2½ tons, 6 x 6	Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	Amount $36,936,055; cargo type, cargo with winch, tank, etc.
Trucks, 4 tons 6 x 6	Diamond T Motor Co., Chicago.	Amount $4,098,570; cargo with winch, wrecker with winch, ponton with winch.
	Autocar Co., Ardmore, Pa.	Tractor Trucks, 4 and 5 ton, 4 x 4; cab over engines.
Semi-trailers	Highway Trailer Co., Edgerton, Wis.	Amount $553,383; two wheel; combination animal and cargo (model 128-c).
Searchlight trailers	Freuhauf Trailer Co., Detroit	Contract W-978-eng-2114 (P.O. 51882)
Air Compressors	Le Roi Co., Milwaukee, Wis.	Contract W-978-eng-1822 (P.O. 51340)
*Radio Set SCR-243	Airplane & Marine Direction Finder Corp., Clearfield, Pa.	Order 1251-NY-41; DP 41-285; Amount $11,427.
*Radio Set SCR-206	Air Communications, Inc., Kansas City, Mo.	Order 647-CHI-41; DP 41-135; Amount $101,827.
*Reel Unit RL-31	Jacobsen Mfg. Co., Racine, Wis.	Order 2063-CHI-41; DP 42-4086; Amount $243,446.
*Signal Generator I-72	Clough-Brengle Co., Chicago, Ill.	Order 2143-CHI-41; DP 41-3193.
*Telegraph Set TG-5	Allen D. Cardwell Mfg. Co., Brooklyn, N. Y.	Order 6699-NY-41; DP 41-1710; Amount $48,256.
Trainers, instrument flying & landing ground	Link Aviation Devices, Binghampton, N. Y.	
Misc. Parts	Air Associates, Inc., Bendix, N. J.	Misc. parts, fittings and accessories.
Goggles, frames & lenses	American Optical Co., Southbridge, Mass.	
Aircraft Engines	Packard Motor Co., Detroit	
Misc. Contracts & items	Bendix Aviation Corp., Bendix, N. J.	
Misc. Contracts & items (such as automatic pilots)	Sperry Gyroscope Corp., Brooklyn, N. Y.	
Fuel Pump Assemblies	Pump Engineering Service Corp., Cleveland, Ohio	
Turbo-superchargers	General Electric Co., Schenectady, N. Y.	

* Contracts to renegotiate.

Pullman-Standard showed over 50 tank parts and about 35 howitzer parts, each tagged completely so a contractor could tell at a glance what was required.

A number of primes told THE IRON AGE that they had done more to unearth worthwhile talent in three days here than in that many months of freelancing on their own. Yet, underneath the satisfaction displayed on both sides was a feeling of desperation about the whole situation. It started from the top with Floyd Odlum, head of the Contract Distribution Division, who told THE IRON AGE that he had the power and the cooperation of everyone to do a job but that the lack of time as well as lack of a sufficient staff presented super-obstacles. It seeped through prime and subcontractors who were coming solidly up against the knowledge that the cream of subcontractors has been skimmed off. In the Chicago Ordnance District alone, there are 370 prime contractors and 6000 subcontractors now engaged in defense production.

Many of the little fellows disconsolately admitted that they didn't have the equipment to get in the picture. Two little fellows from Michigan wanted to know if many had met the same fate as they. "We're going home," they sighed. "Nobody wants sheet metal workers or small machine shops where there are less than 10 machines. Guess we'll have to go on paying premiums for steel and try to get enough for our regular work."

Too many jobs were available on the basis of whole hog or nothing —and if a fellow had turret lathes, he didn't have grinders.

Mr. Odlum revealed a plan he hopes will save non-defense plants. He will try to have the aircraft industry "adopt" the aluminum ware industry, with one aircraft plant being responsible for the output of several aluminum ware firms. In the same manner, tank manufacturers will take automotive accessory makers under their wing, and so on.

"I'm worried about the plants which will never get in the defense program," he said. "When England swung over to all-out defense, over 20,000 plants faded out overnight. If we should do that here, many more than that number would fold up."

Questioned about difficulty of

THEY'LL ALWAYS LOOK FOR THE BIRDIE. Though Western Cartridge Co.'s booth was always crowded with businesslike seekers of subcontracts, everyone took time out to see that he would be visible in this picture.

getting materials even with priorities, he stated that it would not be necessary to make prime contractors provide materials to their "farms." The material question, he feels, is working out.

Mr. Odlum revealed that he plans eventually to employ about 5000 in his division.

He directed a special message to readers of THE IRON AGE who he said comprise the core of the whole defense program. "Tell those who want defense contracts," he said, "to waste no time getting their facilities known to our offices; and also ask them to initiate programs of their own as to what they can produce—and we will do our best to carry the ball from there."

Officials of some 20-odd Wisconsin prime contractors who were represented at the clinic expressed themselves well satisfied with the results obtained.

"This is something OPM should have done at the start of its program," said William E. Keskey of the A. O. Smith purchasing department.

Allis-Chalmers Mfg. Co., Milwaukee, said out of 125 manufacturers interviewed in an average day, 25 per cent were good subcontracting prospects. Falk Corp., Milwaukee, reported: 15 per cent of the inquirers were good material. Gisholt Machine Co., Madison, said the clinic did away with hit-or-miss methods of seeking subcontracts, according to C. W. Swafford, works manager. Giddings & Lewis Machine Tool Co., Fond du Lac, said the OPM conference afforded invaluable aid.

Hourly Steel Wages Today Buy More Than in 1918

• • • **Hourly wages** received by steel workers today go about twice as far as they did in 1918 toward buying certain common articles of food, while their purchasing power for clothing, furniture and other representative manufactured goods shows a still greater increase, according to the American Iron and Steel Institute. In 1918, steel workers received an average of about 58c. per hr., compared with the average of 99c. per hr. in the summer of 1941. The average workweek in the steel industry is currently just under 40 hr. per week as against nearly 67 hr. per week in 1918. The average weekly wage is about the same for both periods because of the much higher hourly rates paid today. Consequently fewer weeks of work are needed to earn enough to buy representative manufactured goods.

Pine Bluff, Ark., Gets Incendiary Bomb Plant

• • • **A plant for the** manufacture and assembly of magnesium and thermite incendiary bombs will be located near Pine Bluff, Ark., the War Department announced last week. One million square feet of floor space will be required for the completed plant, which will employ 2000 persons and will cost several million dollars. It will be government owned and operated.

It is expected that bombs will come off the production line within 10 months after ground is broken.

Aid on Freight Due Iron Makers

Pittsburgh

• • • **Steel mills** or blast furnaces which ship iron upon the direction of OPM from their "pool" into basing point areas other than the one in which the iron was produced, will be granted some form of relief in the matter of freight absorption, THE IRON AGE has learned.

One large steel company here has already been granted specific relief on this type of business (see THE IRON AGE, Aug. 9, 1941, p. 141) but the OPA has not agreed to make such relief measures a general order. Each case, it is said, must be approved by OPA.

Under the present pig iron pricing order, the domestic ceiling price is the aggregate of the basing point price at the governing basing point; differentials and the transportation charges from the governing basing point to the place of delivery as customarily computed. This in effect means that the delivered price of iron is based upon the basing point price at the basing point nearest the point of consumption.

In the specific case of relief already granted, the price was arrived at by taking the basing point price at established basing points at or nearest the point of production plus the actual transportation cost from such basing point to the point of consumption, less a compromise amount of $1 a ton. In other words, on shipments to basing point areas outside of the one where the pig iron is produced, the customer absorbs all the freight costs except a compromise amount of $1 a ton on the material so shipped.

Any pig iron sold from a company's "pool" which is consigned on OPM instructions to distant points, is expected to carry the same relief measures as described above, but pig iron sold on a routine basis will not, it is understood, come under such provision.

Sharon Profits $412,899

Sharon Steel Corp. reports net profit of $412,899 for the third quarter of 1941, compared with $285,988 for the second quarter of the year, and $365,975 for the third quarter of 1940.

Stand-and-Learn Plan Is Success

Pittsburgh

• • • **A northwestern** manufacturer of cutting tools with faith in human adaptability now has a third shift in his plant, thanks to a timely short cut in training.

Less than a year ago he sent out a call to his workmen to bring in friends and relatives who they thought could be quickly turned into machine tool operators. Located near a farming region, the company soon had a group of boys and men applying for the jobs.

About three out of four applying were hired. The manufacturer then instructed groups of the trainees to stand at the various machine tools and watch the operators work. The "stand-ins" watched lathe, turret lathe, assembly bench and drill press operations.

For two or three weeks the "stand-ins" tried their luck at the simpler forms of machine tool operations. The management watched and "weeded" and in three weeks put a group of fifteen to twenty men on the third or midnight shift.

The weeks of watching and asking questions bore fruit to such an extent that the new third shift, composed of the country boys and men, soon actually started work on turning, centering, facing, drilling, tapping and cutting off, all on standard lines of the company.

The new third shift allowed the company to put other more highly skilled operators on special tools engineered for a specific and definite job. Output of standard cutting tools was maintained while production on special tools was carried out.

The tool manufacturer was able to use practically all of the men originally accepted for the third shift. Subsequently some left the company thinking they were full fledged machinists, but approximately seventy-five per cent of the small number who left eventually returned.

Outstanding workmen on the day shift were offered jobs as foremen over the third shift.

Success of the plan was due in large measure to the loyalty of the employees who took pride in the company to such an extent that they recommended boys and men who they sincerely believed would be acceptable.

Of those actually hired for the third shift about thirty per cent were youngsters and about seventy per cent were men over forty.

United Shoe Builds Guns For and Against Tanks

Washington

• • • The United Shoe Machinery Corp., Boston, which ordinarily produces machinery and accessories for the shoe manufacturing trade, was publicized by the War Department last week as being in the unique position of producing guns to arm tanks and guns to destroy tanks.

The Department said that the company, which has already delivered a considerable number of 37 mm. tank guns to the Ordnance Department, recently turned over to the Army its first 37 mm. anti-tank guns. Some of the anti-tank guns, on which quantity deliveries have just begun, will be towed behind trucks, the Department explained.

Magnesium Limestone Development Studied

• • • **Development** of Michigan's magnesium limestone supplies along the southern border of the Upper Peninsula is under consideration by the government, according to Dr. R. A. Smith, state geologist. The purpose of the development would be to obtain an additional supply of magnesium metal for aircraft manufacture. Dr. Smith described the magnesium-bearing dolomite as extending all across the southern border of the peninsula in a strip up to 10 miles wide and 90 ft. deep.

Detroit Priorities Office In New Location

Detroit

• • • **The priorities division** of the OPM, formerly located at 160 W. Fort Street, has moved to the Boulevard Bldg., 7310 Woodward Ave. at Grand Blvd. The priorities office is directed by Walter Hall.

Auto Firms Plan To Expedite Tanks

Detroit

• • • **A plan** to pool the production resources of the Big Three of the automobile industry to make tanks is taking shape. Chrysler, which has been in production on the 30-ton M-3 medium tanks since early summer, has raised its sights toward an objective of 40 tanks per day. In this it will be aided by other Chrysler divisions and will receive armor plate from Ford Motor Co., which is preparing facilities for an output of 300 tons of plate per day.

Ford and GM currently are discussing plans with the War Department for the production of tanks. Ford will make armor plate, some 30-ton tanks and will bear the major portion of the load of producing new 60-ton tanks. Already Henry Ford has given the word to clear out the B Building at the Rouge Plant for tank production.

General Motors plans call for work to be done by Fisher Body and Buick at Flint with the probability that some new plant buildings will be erected.

A phase of the plan was revealed by D. S. Eddins, president of Plymouth. He revealed that Plymouth will tool a portion of its factory for production of tank parts on a quantity basis.

Willys and Ford Will Cooperate to Make 'Jeeps'

Washington

• • • **An agreement** under which the Ford Motor Co. and Willys-Overland Motors, Inc., will both produce identical models of the quarter-ton "jeep" reconnaissance Army truck has been negotiated by the War Department.

As planned, the Ford River Rouge Plant will make its facilities available for the production of a vehicle identical to the model made by Willys-Overland. The War Department said Willys had agreed to furnish complete drawings, licenses, patents, and other manufacturing information without cost.

Banking of Stacks Scheduled Due to Coal Mine Strike

Pittsburgh

• • • **While John L. Lewis** early this week was arguing with President Roosevelt that the captive mine strike would not affect steel production because the steel companies have laid up reserve coal, the U. S. Steel Corp. at midweek was forced to start reducing ingot output in the Pittsburgh and Youngstown districts by 20 per cent, in the Chicago district by 10 per cent, and warned that further reductions would be in order if the strike lasted more than one week. Operations in the Cleveland, Birmingham and West Coast districts were to be unaffected for the time being.

On a companywide basis, however, THE IRON AGE has learned that U. S. Steel Corp. by the end of this week will be off 10 points in steel ingot production and a week later, if the strike continues, output will be down 20 points from capacity with a drastic curtailment estimated at approximately 40 per cent down by the end of the third week if the strike still continues.

Late Tuesday, Carnegie-Illinois and other U. S. Steel subsidiaries began the task of banking several blast furnaces because of the coke shortage. Additional blast furnaces were scheduled to be banked Wednesday and there was a definite likelihood that the Clairton by-product coke operations which furnish coke for blast furnaces as well as gas for finishing mill operations would have to be curtailed. Thus if the strike continues during the rest of the week not only will steel ingot production have been affected but finishing operations on important defense items such as plates for ships and freight cars, bars and munition steel, and structural material for important defense projects will be curtailed. Output of these items will be further curtailed if the strike continues for another week, owing to lack of ingots due to open hearth shutdowns. Early estimates on possible loss of steel production during the balance of this week in case the strike continues are roughly set at 30,000 tons for the Pittsburgh district, 11,000 tons for the Youngstown area, and 14,000 tons for Chicago, making a total of 55,000 tons.

The immediate reduction in urgently needed steel production by the Corporation was caused by the dependence of this company for a portion of its fuel upon so-called beehive coke. The majority of the beehive coke ovens supplying U. S. Steel ceased loading and shipping operations Monday morning. Supplies of coal for production of by-product coke are far below normal, owing to previous strikes in April and September of this year.

Most serious aspect of the captive mine strike is that all steel production which is lost cannot be made up since steel mill units have been working at maximum capacity for months. Any loss is irrevocably dissipated.

Other large steel companies are expected to maintain steel ingot output on an average of from 10 days to three weeks, depending on the company, although THE IRON AGE has learned that stocks of coking coal at by-product coke ovens are somewhat less than is generally thought.

Lewis Will Yield, Observers Expect

Washington

• • • **Just as** he did in the more peaceful days of 1919, it is the conviction here that John L. Lewis will have to yield to the Government and call off the captive mine strike.

Mr. Lewis' reply to the President's appeal early this week was one of defiance, though he attempted to conceal it by claiming that defense output is not impaired and will not be impaired for an indefinite period, and a ponderous declaration that "this fight is only between a labor union and a ruthless corporation—the United States Steel Corp."

"If you would use the power of the state to restrain me, as an agent of labor," Lewis told the President, as if anticipating a crackdown, "then, sir, I submit that you should use that same power to restrain my adversary in this issue."

Lewis went on to say that if Mr. Morgan will permit Mr. Taylor to accept the Appalachian agreement like all other coal operators, then the business can be disposed of in 10 min. and coal production resumed on Thursday." If the country needs additional coal, Lewis said, he would recommend to the mine workers that they make up lost production by working additional days each week until the lost production is regained.

The blunt refusal to the President's original request last Friday to call off the strike has stirred Congress where there is talk—and it may only be talk—of enacting legislation to fasten upon organized labor a control that is as strong as that exercised over industry, particularly during an emergency.

The Lewis strike move was seen as much more than an attempt to force the closed shop on steel-owned captive mines. It was seen, just as in the Kearny Shipyard case, a drive toward a closed shop in steel and all other industries where CIO has gained recognition and is attempting to gain complete labor control.

The captive mine strike call came after the National Defense Mediation Board had refused to recommend the union shop. The board, realizing that such a recommendation would be followed by demands for the closed union shop in other industries, contented itself with making other proposals.

Owning the captive mines where the strike was called are the United States Steel Corp., Bethlehem Steel Co., Republic Steel Corp., Youngstown Sheet & Tube Co., Wheeling Steel Corp., Crucible Steel Co. of America and the National Steel Corp. It is said that the only steel captive mines not affected were those of the Jones & Laughlin Steel Corp. and the Sloss-Sheffield Steel & Iron Co.

Production Resumed at Great Lakes Steel Corp.

Detroit

• • • **Production** was resumed last Friday at the Great Lakes Steel Corp. plant in Ecorse after two factions of the SWOC-CIO had finally reached an agreement sponsored by high CIO officials. The compromise plan includes the reinstatement of 16 union leaders who had been suspended by the regional director for their part in the wildcat strike, election of new local officers, complete financial reports to be forthcoming from the union, and other promises.

Fairless Tells of Coal Strike Effect

• • • **The text** of the Oct. 27 statement by B. F. Fairless, president of U. S. Steel Corp., on the coal strike, follows:

The present strike in the coal mines of United States Steel Corp. subsidiaries makes necessary substantial reductions in our steel-producing operations. In the Pittsburgh and Youngstown districts our subsidiaries will be obliged to reduce steel operations by reason of lack of coal from capacity to approximately 80 per cent, beginning Tuesday, Oct. 29. This immediate reduction is due to the fact that 15 per cent to 20 per cent of the coke used by our Pittsburgh and Youngstown mills is produced by beehive coke ovens which are dependent upon a constant supply of coal. Since there are no facilities for stocking coal at beehive ovens the production is immediately affected by the strike.

Unless work in our coal mines is immediately resumed, this reduced rate of steel operations in the Pittsburgh and Youngstown districts will continue for approximately one week, after which time steel-producing operations in these districts can continue at a gradually diminishing rate for a further period of only about one week.

Beginning tomorrow morning, steel operations of United States Steel Corp. subsidiaries in the Chicago district will be reduced because of lack of available coal from capacity to approximately 90 per cent. With present stocks this reduced rate can be continued for only one week, and thereafter at a gradually diminishing rate for a further period of only about seven days, when steel operations must cease.

In the Cleveland and Lorain districts steel operations of our subsidiaries will be continued at full capacity for two weeks, following which there must be an orderly gradual reduction of steel production due to lack of coal. Approximately 10 days later a complete shut-down of our steel operations in these districts must be anticipated.

In the Birmingham area our subsidiaries have sufficient coal and coke on hand for approximately four weeks of full operations, after which time steel operations must be gradually reduced until complete exhaustion of present stocks.

Conditions similar to those in the Birmingham area prevail at our West Coast steel mills.

The coal strikes of last spring and of last month prevented the accumulation of coal reserves sufficient to maintain higher operations than those stated above.

Welders' Strike Hits Coast Yards

• • • A welders' strike was spreading on the Pacific Coast early this week, hampering defense shipbuilding except for Navy Yard construction. Orders totaling around $800,000,000 were affected. The welders were seeking autonomy from the A. F. of L.

At Brooklyn, N. Y., a strike over a wage issue by 5800 CIO workers at the Robins Drydock & Repair Co. tied up repairs on 14 merchant ships.

Settlement of the 24-day strike at the Bendix, N. J., plant of Air Associates, Inc., arranged in Washington, Oct. 24, hit a deadlock Oct. 28. At Paterson, N. J., the Wright Aero Employees Association, an independent union, planned to ask a wage increase of 10c. per hour for 5000 employees when the current agreement with the company expires Nov. 9.

New Contract Signed for Alabama Coal Mines

Birmingham

• • • **Nearly eight months** after the former two-year contract had expired, a new contract for approximately 12,000 miners employed in Alabama's commercial coal mines was signed here Oct. 24 by the commercial mine operators and United Mine Workers of America (CIO).

The new contract, based on National Defense Mediation Board recommendations, provides an increase of 25c in the daily wage rate with an additional 15c a day to be paid after April 1, 1942, if conditions permit; a washer loss adjustment; and annual vacation pay of $20.

Alabama captive mine operators also accepted the board's recommendations and the captive miners were scheduled to return to work as soon as the dispute over the union shop for captive mines generally was settled. Provisions of the new contract brought the basic daily wage rate for Alabama miners to $5.75.

After Three Years, SWOC Signs Moltrup Contract

Pittsburgh

• • • **The SWOC has** signed an exclusive bargaining contract with the Moltrup Steel Co., Beaver Falls, Pa., following a three-year drive. The NLRB previously found in favor of the union in one of the controversies and was later upheld by the U. S. Circuit Court. The company agreed to bargain with the union in July. The contract just negotiated covers 500 men.

Ceiling Forces Western Mine Out of Business

San Francisco

• • • **Walker Mining Co.** directors, meeting at Salt Lake City, voted to suspend operations of this copper mine, which is controlled by Anaconda through the International Smelting & Refining Co.

Inability to operate at a profit under the present price ceiling of 12c. a lb. for copper was the reason for this action, it was stated. Net loss in 1940 was $290,295.

Walker Mining Co. is the largest California copper producer, having about 500 employees, producing upward of 5000 tons of copper in 1940.

Work Held Up 12 Days

Cleveland

• • • **C.I.O.** attempts to force the Lakeside Steel Improvement Co. to coerce its employees into joining the union have held up the plant's work on defense orders for 12 days.

Crosley Gets Defense Order

Cincinnati

• • • **The Crosley Corp.,** manufacturer of radios and refrigerators, has now been taken into the defense economy, with a $501,000 order for release assemblies. Further broadening of the subcontracting base in the Cincinnati area is anticipated, with other non-defense industries certified for contracts.

OPM Recommends 6 Electric Furnaces at South Chicago

Washington

• • • **Estimated** to cost about $35,000,000, the OPM-recommended Republic Steel Corp. plant at South Chicago, Ill., for the production of electric alloy steel will consist of one 1200-ton blast furnace and six 70-ton electric furnaces. The electric furnaces will have a capacity of 504,000 tons of alloy steel ingots annually, producing 317,000 tons of parts for aircraft and ordnance use, OPM Director General William S. Knudsen announced in asking RFC to finance the construction of the plant.

The ingot production represents slightly over one-half of the 1,000,000-ton increase in alloy steel capacity that was recommended in the SPAB-approved report by W. A. Hauck. Much of the alloy steel will be used for the construction of tanks, whose number, according to the President, will be doubled.

Meanwhile, two other iron and steel expansion projects have been announced. They also will be financed by the Defense Plant Corp. under the "separate unit" method, as distinguished from the "scrambled facilities" method.

One of these two undertakings calls for a new steel plant at Pittsburg, Cal., near San Francisco, to be operated by Columbia Steel Co., a United States Steel Corp. subsidiary, where the company now has a plant. The construction of this plant was recommended last week by Mr. Knudsen. The other project was announced by Federal Loan Administrator Jesse H. Jones and calls for two new 1000-ton blast furnaces, which, with coking facilities, will be located at Provo, Utah, and operated by Columbia. This plant also will be financed by DPC and will cost about $35,000,000. The furnaces will supply pig iron for the new Pittsburg steel plant and will have an annual capacity of about 725,000 tons. Columbia Steel now has one blast furnace at Provo.

It is understood OPM soon will recommend a new thoroughly integrated steel plant to be DPC-financed and operated by Bethlehem Steel Co., at Los Angeles, where this company now has a steel plant. Like the Columbia plant at Pittsburg it will not be dependent on purchased scrap for operations. The two plants, recommended as were the Provo blast furnaces by Mr. Hauck, are designed to make the West Coast "substantially independent of Eastern Mills for its steel supply for strategic and economic reasons as well as to effect decentralization of the steel industry westward."

The proposed plant for Republic at South Chicago was described as unusual in that it will be the first in the country in which every unit from ore to finished product is designed to produce electric furnace alloy steel.

The Columbia plant at Pittsburg will have seven open hearth furnaces with annual ingot output of 750,000 tons, one electric furnace, one 110-ton plate mill with an annual capacity of 500,000 tons, and a foundry with a capacity of 44,100 tons of steel for castings.

Approval of the expanded blast furnace capacity at Provo, Mr. Jones said, brought the total new pig iron capacity to be financed by DPC to about 5,400,000 tons a year. The Hauck report recommended a 6,500,000-ton expansion.

The recommended plant for Bethlehem at Los Angeles would include two blast furnaces, with an annual capacity of 864,000 tons; open hearths, 648,000 tons; electric furnace capacity of 60,000 tons, and finishing capacity for structural shapes, sheet piling, rails, splice bars, tie plates, sheet steel, open hearth carbon and alloy bars and electric alloy bars.

Steel Soars Past 1940 Output Mark

• • • At 12:30 p.m. on Oct. 24, steel production in the United States for 1941 passed the output mark of 66,982,000 tons for the entire year of 1940, according to the American Iron and Steel Institute. The steel industry in the U. S. so far this year has produced about half the steel made in the world. Production for all of 1941 is expected to reach 82 million tons.

$15 Million Gary Expansion Announced by C-I

Chicago

• • • **A $15,000,000** expansion program to provide increased steel and iron making capacity at the Gary steel works has been announced by Carnegie-Illinois Steel Corp. The cost will be borne by the company.

Work will begin immediately on construction of a new open hearth furnace, the rebuilding and enlargement of a blast furnace, installation of greater soaking pit capacity, the rebuilding of a battery of coke ovens, and provision of additional ore unloading facilities.

The new open hearth, to be installed at the No. 5 open hearth department at Gary, will provide increased annual ingot production of 300,000 net tons. Enlargement of Gary Works blast furnace No. 7 to an annual capacity of approximately half a million tons will double its present capacity.

Seventeen rows of soaking pit furnaces will be replaced to increase their capacity from two million to two and one-half million net tons annually. The 70 ovens of by-product coke oven battery No. 6 will be rebuilt to provide an annual capacity of 360,000 net tons of coke. Ore unloading capacity of the plant will be increased from 3000 to 4500 gross tons per hr.

Contract is Awarded For Stack at Gadsden

Birmingham

• • • **Contract** to build the furnace and stoves for the new 800-ton blast furnace to be erected at Gadsden by Republic Steel Corp. has been awarded to Chicago Bridge & Iron Co., of Birmingham. Rust Engineering Co., which holds the contract for excavation, foundations and storage bins, started work on its contract

Two New Electrics Start

Chicago

• • • **Two new** electric furnaces were put in production Oct. 28 at the South Chicago works of Carnegie-Illinois Steel Corp. Electric steel capacity is increased 100,000 tons annually with the two furnaces which have 70 and 30 tons rated capacity per heat, respectively.

Government Awards . . .

War Dept., Ordnance:

Robert Abel, Inc., Boston; electric hoists $1,933

Adirondack Foundries & Steels, Inc., Watervliet, N. Y.; steel castings 1,085

Allegheny Ludlum Steel Corp., Brackenridge, Pa.; gages 4,495

Almac Die & Tool Works, Chicago; jigs and fixtures 1,666

T. R. Almond Mfg. Co., Ashburnham, Mass.; drill chucks 1,100

American Brake & Shoe Foundry Co., American Forge Division, Chicago; shell forgings 161,399
castings 18,288

American Brass Co., Waterbury, Conn.; coils gilding metal 3,363
cartridge case cups 320,305
pipe, seamless steel 1,518

American Broach & Machine Co., Ann Arbor, Mich.; broaching machines 7,185

American Chain & Cable Co., Detroit; assemblies, cable & fittings 4,280

American Hollow Boring Co., Erie, Pa.; steel tubes 23,691

American Tool Works Co., Cincinnati; lathes 4,747

Anderson Engineering Co., New York; dies 4,875

A. R. Meyers, doing business as Araglo Co., Milwaukee; bench filing machines 2,875

Arens Controls, Inc., Chicago; parts for tanks 2,729

Arrow Tool & Reamer Co., Detroit; reamers 1,380

Atlantic Pipe & Supply Co., Boston; pipes for castings 1,999

Atlas Press Co., Kalamazoo, Mich.; lathes and equipment 104,490

Axelson Mfg. Co., Los Angeles; lathes 40,077

Bearings Co. of America, Lancaster, Pa.; parts for tanks 1,188

Belmont Smelting & Refining Works, Inc., Brooklyn; copper ingots 2,624

Bendix Aviation Corp., Eclipse Aviation Division, Bendix, N. J.; parts for tanks 4,046

Bendix Aviation Corp., Scintilla Magneto Division, Sidney, N. Y.; tools 5,568

Belknap Hardware & Mfg. Co., Louisville, Ky.; reamers 1,613

Berger Mfg. Co., S. Boston; steel clothes lockers 3,868

Bethlehem Steel Co., Bethlehem, Pa.; steel 14,660

G. S. Blakeslee & Co., Cicero, Ill.; washing machines 3,174

E. W. Bliss Co., Brooklyn; presses 3,687

Bliss & Laughlin, Inc., Harvey, Ill.; steel 5,443

Bokum Tool Co., Inc., Detroit; tools 8,018

C. C. Bradley & Son, Inc., Syracuse, N. Y.; hammers 6,817

British Purchasing Commission, New York; presses 43,253

Broadway Office Supply & Equipment Co., Springfield, Mass.; steel desks 2,310

Brown & Sharpe Mfg. Co., Providence; milling machines 8,770
adapters 4,279

Budd Wheel Co., Detroit; assemblies, wheel disk and rim 13,864
hub & wheel assemblies 1,199

Buell Die & Machine Co., Detroit; dies 3,649

C. & B. Machine Co., New Haven, Conn.; gages 1,350

California Machinery & Supply Co., Ltd., Anderson, Ind.; parts for tanks 1,450

Carnegie Illinois Steel Corp., Pittsburgh; steel 4,106

Carpenter Steel Co., Philadelphia; steel for tools 13,518

Cedar Rapids Engineering Co. of Delaware, Cedar Rapids, Iowa; grinding machines 9,500

Chase Brass & Copper Co., Inc., Waterbury, Conn.; metal parts for fuzes 83,370
bronze & brass 1,945

Chicago Pneumatic Tool Co., Detroit; riveting machines 1,726

Cincinnati Milling Machine Co., Cincinnati; milling machines .. 11,109

Cincinnati Planer Co., Cincinnati; parts for planer 9,253

W. E. Clark Co., Boston; steel .. 1,104

Cleaver Brooks Co., Milwaukee; boilers 4,906

Cleveland Twist Drill Co., Cleveland; reamers 5,700

Cohn & Rosenberger Co., Inc., Providence; copper gaskets 6,048

Colt's Patent Fire Arms Mfg. Co., Hartford; components, for assembling trigger & safety in backplate 2,433
parts for handles, retracting, assembly 20,181

Arthur Colton Co., Detroit; pelleting presses 258,076

Columbia Steel & Shafting Co., Pittsburgh; steel 2,190

Consolidated Packaging Co., Buffalo; idler pulleys and brackets; and machines, thread cleaning.. 4,504
dipping machines 6,105

Continental Motors Corp., Muskegon, Mich.; parts for tanks 10,199
parts for engines 21,541

Crucible Steel Casting Co., Milwaukee; castings for tanks 2,546

Crucible Steel Co. of America, New York; steel bar, tungsten, molybdenum 4,465
steel 13,876

Cutter Wood & Sanderson, Cambridge, Mass.; wrenches 2,709

Dana Tool-D Nast Machinery Co., Philadelphia; twist drills 1,257

Darwin & Milner, Inc., Philadelphia; steel 1,003

David Tool & Equipment Co., Inc., Chicago; taps, hand 1,989

DeLuxe Metal Furniture Co., Warren, Pa.; steel shelving 1,562

Denison Engineering Co., Columbus, Ohio; presses 120,000

A. P. De Sanno & Son, Inc., Phoenixville, Pa.; tools 11,607

Detroit International Trading Co., Detroit; drive-all units 1,790

Diecasters, Inc., Ridgefield, N. J.; die castings 16,486

Henry Disston & Sons, Inc., Philadelphia; plates 46,236

William Dixon, Inc., Newark; files 1,541

Duff-Norton Mfg. Co., Pittsburgh; gear jacks 1,115

Duro Metal Products Co., Chicago; ratchets 4,770
tools 1,275

Eastern Machine Screw Corp., New Haven, Conn.; tools, thread cutting 4,975

Eaton Mfg. Co., Detroit; casting machines 13,600

Edgecomb Steel Co., Philadelphia; steel castings 2,736

Ekstrom, Carlson & Co., Rockford, Ill.; dies 2,100

Electric Controller & Mfg. Co., Cleveland; parts for crane controls 1,184

Essex Rubber Co., Trenton, N. J.; couplings 1,178

E. L. Essley Machinery Co., Chicago; surface grinders 9,814
drill presses 1,815

John Evan's Sons, Inc., Philadelphia; springs, firing pin 1,696

Exact Weight Scale Co., Columbus, Ohio; scales 23,328

Federal Tool Corp., Chicago; gages 10,265

A. Finkl & Sons Co., Chicago; forgings 1,875

Firth-Sterling Steel Co., Philadelphia; steel 1,684
dies 2,124

Fox Munitions Corp., Philadelphia; gages 4,924

Fruehauf Trailer Co., Detroit; trailers, tractor crane 30,874

Gallmeyer and Livingston Co., Grand Rapids, Mich.; tool cutters 2,306

General Electric Supply Corp., Springfield, Mass.; equipment for electric motors 1,221

General Engineering & Mfg. Co., St. Louis; shapers 12,819

General Motors Corp., Detroit; parts for tanks 17,800
trucks 187,140

General Motors Corp., Yellow Truck & Coach Mfg. Co., Pontiac, Mich.; parts for trucks ... 1,070

General Tool Sales Co., Philadelphia; taps, steel, hand 3,256

Geometric Tool Co., New Haven; chasers 1,114

G. M. Gibson Co., Bellevue, Iowa; gun pins 4,570

Gilbert & Barker Mfg. Co., West Springfield, Mass.; water chests 91,305

Globe Steel Tubes Co., Milwaukee; steel tubing 1,898

Goepfert & Buck, New York; tools 1,060

Great Lakes Steel Corp., Ecorse, Detroit; steel 34,426

Greenfield Tap & Die Co., Greenfield, Mass.; cutting tools 1,345
taps and dies 10,179
gages 2,844

Gries Reproducer Corp., New York; gages 1,752

Grissinger Machine Works, Philadelphia; punches 3,320

Guiberson Diesel Engine Co., Chicago; parts for tanks 8,430
engine parts 3,028

Hall Mfg. Co., Toledo, Ohio; valve seat grinders 1,400

Hall Planetary Co., Philadelphia; machines, thread milling 20,060

Highway Steel Products Co., Chicago Heights, Ill.; packing accessories 138,516

Holo-Krome Screw Corp., Hartford, Conn.; screws 1,174

Illinois Tool Works, Chicago; broaches, rifling 1,800

Index Machine Tool Co., Jackson, Mich.; milling machines 2,346

Ingersoll-Rand Co., Newark; pump, boiler feed 3,894

International Harvester Co., Inc., Davenport, Iowa; parts for tractors 4,133
parts for tanks 4,897
dump trucks 4,897

International Machine Tool Corp., Indianapolis; lathes 34,426

Irwin Auger Bit Co., Wilmington, Ohio; screw drivers 5,874

Jessop Steel Co., Philadelphia; steel tools 2,512

Jones and Lamson Machine Co., Springfield, Vt.; cams 4,446

Jones & Laughlin Steel Corp., Pittsburgh; steel 2,638

Jones Machine Tool Works, Inc., Philadelphia; machine tools ... 90,112

John P. Kelly, Philadelphia; castings; bearings, etc. 2,217

Walter Kidde & Co., Inc., New York; fire extinguishers 19,474

Koppers Co., Bartlett - Hayward Division, Baltimore; weldments. 221,500

H. R. Krueger & Co., Detroit; facing machines 10,065

Kux-Lohner Co., Chicago; pelleting presses 126,250

LaSalle Steel Co., Chicago; steel, manganese 2,317

Latham Engine Co., Pittsburgh; gages 1,605

Latrobe Electric Steel Co., New York; steel bar 4,021

Lima Armature Works, New York; gearshift motors 1,849

Link-Belt Co., Indianapolis; castings, malleable iron 1,331
Lowell Wrench Co., Worcester; wrenches 16,368
Ludlum Steel Corp., Watervliet, N. Y.; steel tools 1,222
Lukens Steel Co., Coatesville, Pa.; steel 4,699
Lux Clock Mfg. Co., Waterbury, Conn.; gears 106,491
Madison-Kipp Corp., Madison; die-casting machines; furnaces and pyrometers 5,940
Magee Sheet Metal Machinery Co., Ypsilanti, Mich.; parts for machines 3,600
Majestic Tool & Mfg. Co., Detroit; fixtures 1,150
E. J. Manville Machine Co., Waterbury, Conn.; headers, ball ... 23,882
Mattatuck Mfg. Co., Waterbury, Conn.; parts for primers 40,000
ammunition parts 2,257
McGill Mfg. Co., Valparaiso, Ind.; parts for tanks 1,140
Mead Screw Products, Inc., Detroit; shot 140,000
Metals Reserve Co., Washington; pig tin 5,824
Metro Tool & Gage Co., Chicago; gages 1,065
Michigan Tool Co., Detroit; cutters, milling, high speed steel 4,888
Micromatic Hone Corp., Detroit; machines and tools 5,083
Midwest Tool & Mfg. Co., Detroit; cutting tools 7,781
Midwestern Tool Co., Chicago; machine tools 9,080
Miles Machinery Co., Saginaw, Mich.; lathes 11,460
Miller Printing Machinery Co., Pittsburgh; parts for tanks 13,057
Millers Falls Co., Greenfield, Mass.; gages 7,267
Modern Collet & Machine Co., Philadelphia; collets 1,058
Modern Tool & Die Co., Philadelphia; gages 11,160
Molded Insulation Co., Philadelphia; parts for tanks 4,680
Monarch Machine Tool Co., Sidney, Ohio; lathes, precision ... 22,608
Morton Mfg. Co., Chicago; ammunition chests 225,850
Motor Tool Mfg. Co., Detroit; centers, live, motor tool 2,327
Murchey Machine & Tool Co., Detroit; chasers and die heads ... 5,290
National Broach & Machine Co., Detroit; broachers 2,650
National Twist Drill & Tool Co., Detroit; twist drills 3,118
cutters 1,673
Herman Nelson Corp., Moline, Ill.; targets 8,753
Niles-Bement-Pond Co., Pratt & Whitney Division, West Hartford; barrel drilling machines.. 46,350
drill tips 11,400
taps 1,194
adapters 4,038
drills 7,125
Norton Co., Worcester; grinding wheels 1,038
grinding machines 12,993
O. K. Tool Co., Shelton, Conn.; tool holders, end mills, blades, cutters, & tool bits 3,291
O'Brien Machinery Co., Philadelphia; machine tools 163,120
Arthur J. O'Leary & Son Co., Chicago; springs and die charges 12,047
Ohio Steel Foundry Co., Lima, Ohio; molybdenum castings ... 113,321
Ohio Tool Co., Cleveland; gages.. 12,300
Oliver Farm Equipment Co., Chicago; projectiles 228,837
Oliver Machinery Co., New York; lathes 1,327
Samuel Olson Mfg. Co., Inc., Chicago; conveyors, roller gravity. 2,527
Otis Elevator Co., Buffalo; steel castings 85,268
Otis Steel Co., Cleveland; steel .. 6,523
Peoria Tractor & Equipment Co., Representative of Caterpillar Tractor Co., Peoria, Ill.; parts for tractors 29,731
Philadelphia Bronze & Brass Corp., Philadelphia; forgings 1,810
Pipe Machinery Co., Cleveland; gages 13,742
Pittsburgh Tube Co., Pittsburgh; steel tubing 12,390
Poor & Co., Canton Forge & Axle Works, Canton, Ohio; forgings for tanks 12,182
Henry Prentiss & Co., Boston; boring, drilling and milling machines 162,229
Pullman-Standard Car Mfg. Co., Butler, Pa.; forgings 336,432
N. Ramsohoff, Inc., Cincinnati; machines, tumbling and cleaning 1,925
Rapid Mfg. Co., Inc., Pittsburgh; magazine closing disks 1,800
Reasoner Tool & Supply Co., Boston; twist drill and reamers .. 1,586
Reed Mfg. Co., Erie, Pa.; strap wrenches 7,467
Remington Arms Co., Inc., Bridgeport, Conn.; cartridges 32,380
Republic Gage Co., Detroit; gages 1,683
Republic Steel Corp., Chicago; steel 10,470
Revere Copper & Brass Co., New Bedford, Mass.; bronze bars .. 3,365
brass rods 25,538
Revere Copper & Brass, Inc., Rome Mfg. Co. Division, Rome, N. Y.; brass forgings 215,250
Robinson Mfg. Co., Muncy, Pa.; preheaters 26,997
Roessler Machine Co., Philadelphia; rings, stripper 1,032
Roller-Smith Co., Bethlehem, Pa.; balances and pans 70,800
Rollway Bearing Co., Inc., Syracuse, N. Y.; bearings 13,299
S K F Industries, Inc., Philadelphia; ball bearings 9,005
Safe Guard Corp., Lansdale, Pa.; gages 3,109
George Scherr Co., Inc., New York; gages 1,463
Scovill Mfg. Co., Waterbury, Conn.; metal parts for booster 63,000
primer, percussion 121,500
boosters 68,000
Scully-Jones & Co., Chicago; tools 3,420
Seamless Products Co., Inc., New York; oilers 1,075
Service Caster & Truck Co., Somerville, Mass.; lifter maintenance. 1,373
Service Supply Corp., Philadelphia; tractors 3,705
Lewis Shepard Sales Corp., Watertown, Mass.; tote boxes 1,390
Sieg Co., Davenport, Iowa; wrenches and adapters 11,917
Simplicity Mfg. Co., Port Washington, Wis.; reborers, cylinder ... 2,668
boring machines 2,216
Sipp-Eastwood Corp., Paterson, N. J.; cutters 6,917
Smith & Wesson, Inc., Springfield, Mass.; gun parts 3,030
Stamford Rolling Mills Co., Springdale, Conn.; coils, gilding metal 12,100
Standard Gage Co., Inc., Poughkeepsie; gages 14,749
Standard Machinery Co., Providence; bearings 2,113
Standard Pressed Steel Co., Jenkintown, Pa.; plugs, firing 1,712
Stanley Works, Stanley Tools Division, New Britain, Conn.; screw drivers 2,507
punches 4,857
Steel Shot & Grit Co., Inc., Boston; shot, annealed 1,056
Sterling Products Co., Moline, Ill.; tools and wrenches 6,639
Stewart-Warner Corp., Chicago; parts for tanks 2,125
F. J. Stokes Machine Co., Philadelphia; pelleting presses 313,570
B. F. Sturtevant Co., Hyde Park, Mass.; compressors, centrifugal. 1,360
Superior Die Casting Co., Cleveland; die castings 8,578
Swind Machinery Co., Philadelphia; milling machines and toolmakers' lathes 41,081
Taft-Peirce Mfg. Co., Woonsocket, R. I.; tools 1,632
Taylor Davis, Inc., Philadelphia; steel 1,242
Taylor-Wharton Iron & Steel Co., Easton, Pa.; cylinders, compressed gas 5,795
Tecumseh Products Co., Tecumseh, Mich.; shot 169,000
Templeton, Kenly & Co., Chicago; jacks, ratchet 1,815
Texas Co., Beacon, N. Y.; diesel engines 2,000
Thurston Mfg. Co., Providence; milling cutters 6,381
Timken Roller Bearing Co., Canton, Ohio; bearings 1,801
steel tubing 2,094
Titeflex Metal Hose Co., Newark; tube assemblies and adapter elbows 3,301
Triad Tool & Die Co., Newark; pins, bolts, punches, etc. 13,219
Triplex Machine Tool Corp., Dayton, Ohio; screw machines 4,538
Triumph Explosives, Inc., Elkton, Md.; fuze assemblies 75,445
Tungsten Electric Corp., Union City, N. J.; dies 3,667
Uchtorff Co., Inc., Davenport, Iowa; ammunition chests 515,565
Union Electric Steel Co., Pittsburgh; tube forgings 177,450
Union Hardware Co., Torrington, Conn.; rods, rifle cleaning 6,591
Union Twist Drill Co., Athol, Mass.; reamers 1,141
U. S. Tool Co., Inc., Ampere, East Orange, N. J.; milling machines 1,985
U. S. Tool & Mfg. Co., Dearborn, Mich.; milling cutters 1,465
Universal Crusher Co., Cedar Rapids, Iowa; cradle assemblies ... 17,695
Vandyck Churchill Co., Philadelphia; parts for centering machines 1,583
Veit & Young, Philadelphia; dies, bottom 6,480
Vickers, Inc., Detroit; valves and pumps 1,728
Vickers, Inc., Waterbury Tool Division, Waterbury, Conn., relief valves 19,000
Vulcan Crucible Steel Co., Aliquippa, Pa.; steel tools 1,365
Walker Mfg. Co., Racine, Wis.; jacks 1,180
Walworth Co., Boston; pipe 1,963
Ward LaFrance Truck Corp., Elmira Heights, N. Y.; generator assemblies 1,050
gas tank assemblies 1,250
J. M. Warren & Co., Troy, N. Y.; drill presses; motors; manual starters; and mounting parts .. 1,731
Washburn Co., Worcester; safety wires 1,024
Webber Gage Co., Cleveland; blocks, gage 7,500
Western Cartridge Co., East Alton, Ill.; cartridges 204,102
Western Machine Tool Works, Holland, Mich.; tapping machine .. 838
White Flomatic Corp., Hoosick Falls, N. Y.; castings 1,191
White Motor Co., Cleveland; shaft & tube assemblies; brake boosters and gaskets 2,103
distributors, hoses & springs .. 1,826
Wishen Machine Tool Works, New York; gages 1,124
Alan Wood Steel Co., Conshohocken, Pa.; steel 1,056
Wright Aeronautical Corp., Paterson, N. J.; repair tools and equipment 3,576
engine parts 10,884
Yankee Metal Products Corp., Norwalk, Conn.; parts for tanks .. 11,604

Youngstown Sheet & Tube Co., Youngstown, Ohio; steel 7,906
Zimmerman Steel Co., Bettendorf, Iowa; steel castings 9,320
Zipit Corp., Philadelphia; gages .. 2,840

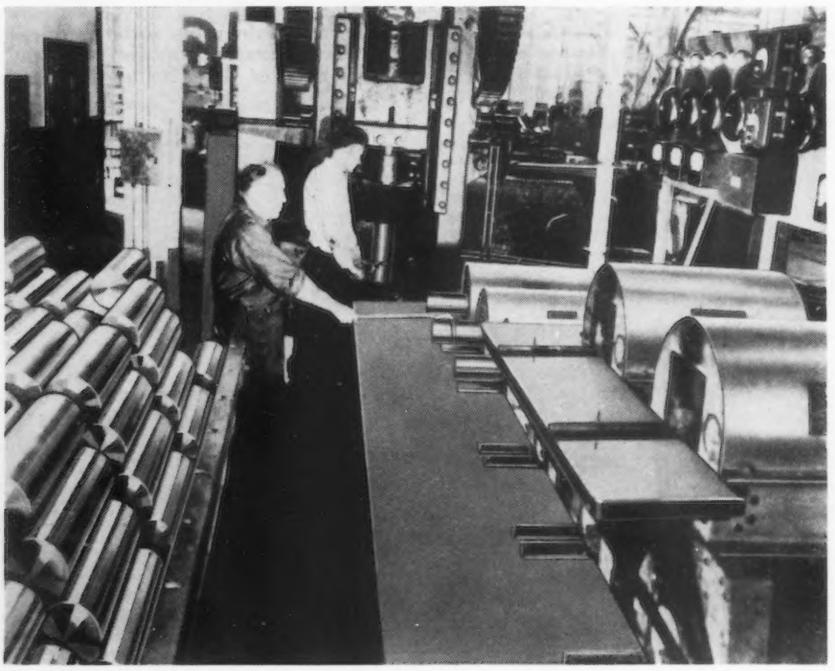
War Dept., Corps of Engineers:

Acme Building Supply Co., Meridian, Miss.; millwork $16,640
Air Conditioning Engineers, Mobile, Ala.; water coolers 17,690
Alban Tractor Co. Inc., Baltimore; disk and tractor plows 11,832
harrows and parts 3,309
Albert & Davidson Pipe Corp., Brooklyn; pipe and fittings 21,037
American Machine & Metals, Inc., Washington; marking machines, insulating rubbers and belts ... 2,067
American Machine & Metals, Inc., East Moline, Ill.; laundry equipment for hospitals 92,545
American Monorail Co., Cleveland; monorail conveyor system, Aviation Mechanics' Training School, Keesler Field, Biloxi, Miss. 12,600
American Rolling Mill Co., Middletown, Ohio; equipment 7,200
American Saw Mill Machinery Co., New York; sawmill 4,789
Anchor Equipment Co., New York; coffee urns, griddles, pans, etc.. 8,013
Armco International Corp., Middletown, Ohio; welders 7,852
steel buildings 90,200
ammunition storage units 5,916
galvanized pipes with fittings .. 95,258
Atlas Fence Co., Philadelphia; fence, U. S. Engineer Reservation, Mayport, Fla. 1,611
Austin-Western Road Machinery Co., Aurora, Ill.; rollers 15,728
Barber-Greene Co., Aurora, Ill.; mixing plants, finishing machines 33,130
Bender Welding & Machine Co. Inc., Mobile, Ala.; metal stacks. 2,611
Birmingham Tank Co., Division of the Ingalls Iron Works Co., Birmingham, Ala.; metal tanks ... 17,340
Blaw-Knox Co., Blawnox, Pa.; steel road forms, concrete finishers .. 14,958
airplane hangars 112,406
S. F. Bowser & Co. Inc., Fort Wayne, Ind.; gasoline pumps and parts 3,018
Charles Bruning Co. Inc., Los Angeles; drafting machines 2,194
levels, dumpy 8,330
Buckeye Portable Tool Co., Dayton, Ohio; pneumatic drills, Aircraft Assembly Plant, Kansas City, Kans. 4,395
shovels with equipment 129,253
Buda Co., Harvey, Ill.; parts for engines 3,575
Buffalo Bolt Co., North Tonawanda, N. Y.; bolts and boat spikes ... 6,351
Buffalo Forge Co., Buffalo; power benders, V-bolts, bar-cutters and shear blades 27,275
Butler Bin Co., Waukesha, Wis.; portable bins 2,430
Capital Steel & Iron Co., Oklahoma City; hangar doors, Advanced Twin Engine Flying School, Columbus, Miss. 9,800
Carey Machinery & Supply Co., Washington; chucks, presses, vices, and drilling machines ... 4,550
Carnegie-Illinois Steel Corp., Johnstown, Pa.; turnouts 5,375
Carver Pump Co., Rock Island, Ill.; pumping sets 75,715
J. I. Case Co., Racine, Wis.; tractors 3,217
Caterpillar Tractor Co., Washingtons; diesel engines and tools for marine engines 5,627
tractors and graders 706,291
Cen-Tennial Cotton Gin Co., Columbus, Ga.; duct work, smoke stacks caps, smoke pipe hoods, etc., Grimes Advanced Single Engine Flying School, Dothan, Ala. 20,532
Chicago Freight Car Parts Co., Chicago; flat cars 33,250
Chicago Pneumatic Tool Co., Philadelphia; air compressors 16,055
Clamshell Bucket Sales Corp., Long Island City, N. Y.; buckets and replacement parts 12,892
Cleveland Trencher Co., Cleveland; ditchers and parts 20,137
Cole Supply Co., Ltd., Tuscaloosa, Ala.; gate valves and valve boxes 9,527
Colt's Patent Fire Arms Mfg. Co., Hartford; dishwashers 2,531
Columbia Steel Co., Washington; sheets, steel, galvanized 2,065
Columbian Steel Tank Co., Kansas City; metal tanks 11,091
Construction Machinery Co., Waterloo, Iowa; concrete mixers 18,200
Contractors Machinery Co. Inc., Batavia, N. Y.; rollers and parts 5,540
Crane Co., Birmingham, Ala.; steel pipe 2,846
Crane Co., Washington; scullery and vegetable sinks 3,600
plumbing supplies 50,253
Cullen-Friestedt Co., Chicago; cranes 13,819
Danes, Dancker, Lane, Inc., New York; office equipment 7,551
Darby Products of Steel Plate Corp., Kansas City, Kans., welded steel work barge 3,444
bunk frames and chain 17,139
DeWalt Products Corp., Lancaster, Pa.; framing and crosscut saws 4,287
Electric Arc Inc., Newark; arc welding machines 3,330
Ensign-Pickford Co., Simsbury, Conn.; primacords and fuses .. 122,280
E. D. Etnyre and Co., Oregon, Ill.; distributors 11,550
Fairbanks Morse & Co., Atlanta, Ga.; pumps, Advanced Single Engine School, Moultrie, Ga. ... 9,227
Fairmont Railway Motors, Inc., Fairmont, Minn.; railway cars.. 5,206
Faspray Corp., Red Bank, N. J.; dishwashers 11,625
Federal Mfg. Co., Brooklyn; roasting kettles 2,480
Food Machinery Corp., Peerless Pump Division, Canton, Ohio; pump and appurtenances, Moultrie, Ga., Advanced Single Engine School 2,682
Franceschi Construction Co., San Francisco; storage spur track, Bakersfield, Cal., Flying Field, No. 2 7,650
Fried, Beall & Sharp Co., Washington; wire rope 3,412
Fruehauf Trailer Co., Detroit; trailers 30,427
General Cable Corp., Washington; cable and wire 7,709
General Electric Co., Schenectady; locomotives, Diesel-electric 65,500
General Motor Corp., Cleveland Diesel Engine Division, Cleveland; spare parts for diesel engines 8,993
General Motors Corp., New York; refrigerator condensing units, drinking water coolers and copper tubing 5,673
Gloekler Mfg. Co., Erie, Pa.; refrigerators 6,999
Goulds Pumps, Inc., Seneca Falls, N. Y.; pumping sets and parts. 13,140
Graybar Electric Co. Inc., Washington; cable, ground rods, ground clamps, transformers and safety switches 5,125
Hall, Peacock & Moore, Mariana, Fla.; ford trucks, Grimes Advanced Single Engine Flying School, Dothan, Ala. 5,000
Harris Seybold Potter Co., Cleveland; presses, lithographic 73,000
Homelite Corp., Port Chester, N. Y.; generating sets 2,655
Huber Mfg. Co., Marion, Ohio; rollers 38,271
J. H. Hudgins, Atlanta; dump trucks, Grimes Advances Single Engine Flying School, Dothan, Ala. 14,000
Hussmann-Ligonier Co., St. Louis; refrigerators 14,913
Independent Pneumatic Tool Co., Chicago; drills, hammers, busters, wrenches, rivets and chisels 2,162
Ingersoll-Rand Co., Washington; air compressors 75,716
Ingersoll-Rand Co., New York; riveters, Aircraft Assembly Plant, Tulsa, Okla. 45,554
Iowa Manufacturing Co., Cedar Rapis, Iowa; portable crushing and screening plants 52,260

NAZI FISH CAUGHT ALIVE: The first German submarine to be captured intact is brought into a British port. The submarine was forced to the surface by a Catalina flying boat which guarded its prize until British war vessels arrived on the scene.

Iron & Steel Products, Inc., Chicago; railroad cars 16,659
Irwin Auger Bit Co., Wilmington, Ohio; bits, shop auger 14,322
International Harvester Co., Washington; motor trucks 19,400
Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio; vacuum cleaners, Aircraft Assembly Plant, Tulsa, Okla. 3,982
Jabes Burnes & Sons, Inc., New York; coffee roasting plant 10,856
C. R. Jahn Co., Chicago; trailers. 6,825
trailers, semi- 13,528
Johnson Electric Supply Co., Cincinnati; cables, Wright Field and Patterson Field, Ohio 5,505
Johnson Motors, Waukegan, Ill.; kits, conversion 7,400
A. F. Jorss Iron Works, Inc., Washington; equipping searchlight shop units 25,337
Josiah Anstice & Co., Inc., Rochester, N. Y.; potato peelers 6,936
Koehring Co., Milwaukee, Wis.; shovels 43,493
Kohler Co., Kohler, Wis.; electric plant, air circuit breaker 9,535
LaCrosse Trailer and Equipment Co., LaCrosse, Wis.; trailers ... 27,870
R. K. LeBlond Machine Tool Co., Cincinnati; lathes 2,603
Lee & Thatro Equipment Co., Los Angeles; street sweepers, Aircraft Assembly Plant, Tulsa, Okla. 6,300
R. G. LeTourneau, Inc., Peoria, Ill.; rollers, rooters and scrapers and carryall parts 75,958
cranes and parts 10,236
Littleford Bros., Cincinnati; heating kettles 5,082
water distributors and parts ... 55,018
Majestic Mfg. Co., St. Louis; ranges 6,322
Martin Electric Co., Dayton, Ohio; cables, Patterson Field, Fairfield Air Depot, Osborn, Ohio 2,139
May Hardware Co., Washington; door locks, bolts, hasps, hinges and window butts 5,181
A. Y. McDonald Mfg. Co., Dubuque, Iowa; pumping sets 16,226
McMaster Carr Supply Co., Chicago; locks, latches, springs, etc. 2,371
bronze chain, bolts and screws.. 4,498
pumping units, suction and discharge hoses and couplings 3,866
McWane Cast Iron Pipe Co., Birmingham, Ala.; pipe and fittings, Tyndall Field, Panama City, Fla. 10,942
pipe and fittings 3,077
John Merrill, Dayton, Ohio; trucks, Wright Field, Ohio 2,880
Moore-Handley Hardware Co., Birmingham, Ala.; steel split rings, Grimes Advanced Single Engine Flying School, Dothan, Ala. 2,191
Mundet Cork Corp., New Orleans; meat rail racks, etc., Aviation Mechanics' Training School, Keesler Field, Biloxi, Miss. 2,375
Geo. F. Muth Co., Inc., Washington; drawing instruments 50,744
Mutual Mfg. & Supply Co., Dayton, Ohio; pipe, fittings, etc. 3,337
National Sales Co., Jackson, Miss.; steam kettles 9,870
Nichols Electric Co., Dayton, Ohio; cable 6,168
Noland Co. Inc., Montgomery, Ala.; fire hydrants, Tyndall Field, Panama City, Fla. 5,722
plumbing supplies 5,073
Noland Co. Inc., Montgomery, Ala.; plumbing supplies, Pilot Training School, Tuskegee, Ala. 5,073
Noland Co. Inc., Washington; pipe fittings 8,738
Novo Engine Co., Lansing, Mich.; pumps, centrifugal and diaphragm 2,488
trench pumping outfits and parts 4,071
hoists 2,161
Ohio Locomotive Crane Co., Bucyrus, Ohio; crane, locomotive .. 134,490
Oliver Machinery Co., New York; saw benches 2,825
D. W. Onan & Sons, Minneapolis; generator sets and parts 8,000
Osgood Co., Marion, Ohio; repair parts for shovels 22,366
Pacific Corrugated Culvert Co., Alhambra, Cal.; copper steel base metal 25,244
P. B. Palhemus Co., Inc., Washington; salad and dessert pans, steam tables and display stands, New Bolling Aviation Field, Anacostia, D. C. 2,304
Paving Supply & Equipment Co., Washington; portable saws 4,771
pumping sets and parts 42,682
pumps and parts 8,068
cranes, tractor 6,783
parts for grades 7,281
hammers 10,980
Peerless Bread Machinery Corp., Sidney, Ohio; dough mixing machines and water meters, Aviation Mechanics' Training School, Keesler Field, Biloxi, Miss. 4,965
Peerless Pump Division, Food Machinery Corp., Canton, Ohio; pumping sets, pipe, etc. 9,219
H. O. Penn Machinery Co., Inc., New York; parts for harrows, drum rollers and cranes 7,015
Pioneer Engineering Works, Inc., Minneapolis; rock crushing and screening plants 67,872
J. C. Pitman & Sons, Inc., Lynn, Mass.; deep fat fryers 4,103
Powers Co., Mobile, Ala.; transits and wye levels 2,159
Priggen Steel Buildings Co., Cambridge, Mass.; steel building frames 25,000
Pullman Co., Chicago; cars, hospital, ward 104,991
Ransome Concrete Machinery Co., Dunellen, N. J.; mixers, concrete 23,680
Read Machinery Co., Inc., York, Pa.; puree mixers 13,580
Ferd J. Robers Construction Co., Burling, Wis. & LaCrosse Dredging Corp., Minneapolis; construction of Mill Creek Pump Station, Cincinnati 2,439,642
John A. Roebling's Sons Co., Trenton, N. J.; portable military cableways, Ft. Belvoir, Va. 57,128
Revere Copper and Brass Inc., Baltimore; copper, sheet and bar .. 4,755
Reynolds Wire Co., Dixon, Ill.; cloth, wire, copper 24,673
Savory, Inc., Newark; toasters .. 5,451
A. B. Sheet Metal Co., Chattanooga, Tenn.; ventilators 3,089
Sheriff Motor Co., Washington; tractor-type trucks 19,191
David Smith Steel Co. Inc., Brooklyn; steel bar stock 12,384
John E. Smith's Sons Co., Buffalo; food and meat choppers, electric 4,602
Thos. Somerville Co., Washington; water supply equipment 14,728
Southwest Industrial Equipment Co., Dallas; castors, Aircraft Assembly Plant, Kansas City, Kans. 9,681
Standard Gas Equipment Corp., New York; ranges and ovens .. 3,978
L. S. Starrett Co., Athol, Mass.; gages, steel rules, tapes, trammels, scribers, etc. 2,615
S. W. Steinmetz, Washington; oil burning ranges and kitchen utensils 4,832
Stewart-Warner Corp., Chicago; portable service stations 6,612
Sullivan Machinery Co., New York; Sullivan drills and parts 32,286
repair parts and accessories ... 5,239
Texas and New Orleans Railroad Co., Houston; cranes 12,000
Texas & Pacific Railway Co., Dallas; locomotives 91,470

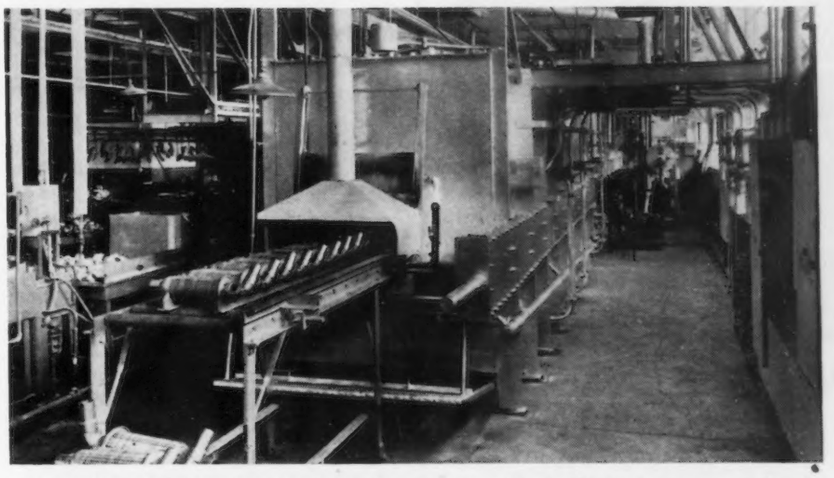
SHELL OUTPUT climbs with inductive heat: Below is a battery of Ajax-Northrup 960-cycle induction heaters in one of the country's biggest arsenals, heating 5-in. shells prior to nosing. Installations have been made and are at work heating for nosing 90 mm., 105 mm., 5-in. and 155 mm. shells. The heaters are made by Ajax Electrothermic Corp., a division of Ajax Metal Co., Philadelphia.



Thew Shovel Co., Lorain, Ohio; cranes and parts 68,234
Timber Engineering Co., Washington; connectors 2,328
Timpte Brothers, Denver; trailers 9,335
Truscon Steel Co., Youngstown, Ohio; steel windows 2,470
hangar doors 9,230
Twin Disc Clutch Co., Racine, Wis.; clutch repair parts 2,693
Union Steel Products Co., Albion, Mich.; dough troughs, bread racks, pan trucks, Aviation Mechanics' Training School, Keesler Field, Biloxi, Miss. 2,259
United States Pipe & Foundry Co., Chicago; water pipe fittings, Chanute Field, Rantoul, Ill. ... 2,166
United States Steel Export Co., Washington; steel, reinforcing.. 3,763
pipe steel, galvanized 22,932
structural steel frame 3,045
chain link fabric 13,041
nails 4,259
United Steel Fabricators, Inc., Wooster, Ohio; culvert pipes ... 9,258
Virginia Steel Co., Inc., Richmond; contraction and expansion joint assemblies, etc. 11,386
Vulcan Iron Works, Wilkes-Barre, Pa.; locomotives 27,565
Wallace & Tiernan Co., Inc., Newark; water purification units .. 90,197
Wayne Iron Works, Wayne, Pa.; control towers 29,090
Wesco Construction Co., Chattanooga, Tenn.; rollers, spreaders, Grimes Advanced Single Engine Flying School, Dothan, Ala. ... 3,487
Wheeling Steel Corp., Wheeling, W. Va.; pipe couplings 2,494
steel galvanized pipe 9,345
Wilson & Bennett Mfg. Co., Jersey City; steel drums 7,978
Wood Roadmixer Co., Alameda, Cal.; road mixers 29,961
Youngstown Sheet & Tube Co., Washington; nails 4,442

War Dept., Chemical Warfare Service:

American Can Co., New York; containers, metal $1,464
American Emblem Co., Inc., New York; brass grommets and washers 11,247
Baldwin Laboratories, Franklin, Pa.; outlet valve guards 17,834
Eastern Tool Mfg. Co., Bloomfield, N. J.; hook & eye clasps 11,016
Mack Molding Co., Arlington, Vt.; guards, outlet, valve 11,402
National Lead Co., New York; solder, tin lead 4,979
National Stamping Co., Detroit; clamps, outlet valve 21,200
Revere Copper & Brass, Inc., Rome, N. Y.; inner tube nozzles 41,580
brass ferrules 19,530
loops, brass 1,344
Stanley Works, New Britain, Conn.; guards, outlet valve 4,260
United Carr Fastener Corp., Cambridge, Mass.; buttons and washers 22,338
United Steel Barrel Co., Philadelphia; drums 20,800
Wackman Welded Ware Co., Chester, Pa.; drums 23,400
Diamond Mfg. Co., Wyoming, Pa.; tinplate 16,861
Milwaukee Stamping Co., Milwaukee; nozzles 1,104
G. E. Prentice Mfg. Co., New Britain, Conn.; hook clasps 5,280
Quality Buckle Co., Pawtucket, R. I.; buckles, web strap 5,182
Salta Corporation, Jersey City; outlet valves 12,500
Stevens Metal Products Co., Niles, Ohio; steel drums 16,640
United Carr Fastener Corp., Cambridge, Mass.; gas mask fittings 13,762



BRAZING GROUSERS: Novi Equipment Co., Novi, Mich., is an example of a small town auto parts plant that is filling voids with defense work. In the same furnace where heater units for automobile hot air heaters are hydrogen brazed, it is now brazing grousers for medium tanks. A grouser is a metal overshoe on tank treads that helps when the going gets slippery and mucky. Another role which the company is playing in the defense program is the manufacture of accelerator parts for Ford reconnaissance cars and trucks that are used both in this country and in Canada. In this photograph is shown the 100 ft. brazing surface used for grouser treads and heater units. About 1800 parts can be hydrogen brazed each hour in this furnace.

War Dept., Quartermaster Corps:

Akron Lamp & Mfg. Co., Akron, Ohio; lanterns, gasoline $48,720
American Fork & Hoe Co., Cleveland; component parts for tool kits, carpenters' 1,022
sledges 467
E. C. Atkins and Co., Indianapolis; component parts for tool kits, carpenters' 4,259
Belknap Hardware & Mfg. Co., Inc., Louisville, Ky.; component parts for tool kits, horseshoers' 509
same, blacksmiths' 2,246
Big Four, Inc., Newark; component parts for tool kits, carpenters' 303
Bowers Battery Mfg. Co., Inc., Reading, Pa.; repair parts 1,736
Dover Stamping & Mfg. Co., Cambridge, Mass.; tin dippers 1,056
Fargo Motor Co., Detroit; limousines, 8-passenger 1,195
Firestone Tire & Rubber Co., Akron, Ohio; repair parts 8,798
General Electric Co., Detroit; Mich.; repair parts 1,081
General Motors Corp., Chevrolet Division, Milwaukee; trucks, 1½-ton 1,157
General Motors Parts Division, General Motors Sales Corp., Detroit; repair parts 4,219
Heller Brothers Co., Newark; component parts for tool kits, blacksmiths' 4,068
Mack Mfg. Corps., Plainfield, N. J.; repair parts 99,586
Mayhew Steel Products, Inc., Shelburne Falls, Mass.; component parts for tool kits, blacksmiths' 1,199
Shirley, Olcott & Nichols, Washington; repair parts 16,330
U. S. L. Battery Corp., Niagara Falls, N. Y.; repair parts 5,498
Vaughan Novelty Mfg. Co., Chicago; openers, can 850
R. Wallace & Sons Mfg. Co., Wallingford, Conn.; table knives and forks 45,600
spoons 17,600
Yellow Truck and Coach Mfg. Co., Pontiac, Mich.; trucks, 1½-ton. 2,845

War Dept., Signal Corps:

Acorn Insulated Wire Co., Brooklyn; wire $2,019
Alden Products Co., Brockton, Mass.; keys 8,192
American Electrical Heater Co., Detroit; soldering iron 2,576
American Phenolic Corp., Chicago; cable 140,200
Boom Electric & Amplifier Co., Chicago; tool sets, etc. 88,270
Camillus Cutlery Co., New York; knives 588
Commercial Stamp Co., Philadelphia; tool equipment 3,877
Conco Engineering Works, Division H. D. Conkey & Co., Mendota, Ill.; reels 1,465
Eastern Steel Tank Corp., Brooklyn; tanks 500
Thomas A. Edison, Inc., Washington; electrical equipment 3,500
Fred Ehrick Co., Brooklyn; rolls. 523
Froiland Mfg. Co., Springfield, Mass.; couplings 7,500
General Cable Corp., New York; cable and reels 2,903
Graybar Electric Co., Inc., New York; cable and reels 56,187
bolts and wire 2,206
jacks 1,060
W. S. Jenks & Son, Washington; gages 1,675
Karp Metal Products Co., Inc., Brooklyn; table frames and tops 959
Kellogg Switchboard & Supply Co., Chicago; anchor stakes 550

War Dept., Air Corps:

Ryan Aeronautical Company, San Diego, Cal.; airplanes $103,000

War Dept., Medical:

Clark Tractor Division of Clark Equipment Co., Battle Creek, Mich.; tractors $5,184
Simmons Co., New York; steel beds 13,800
Stors Instrument Co., St. Louis; forceps 4,400
Union Dental Instrument Mfg. Corp., Philadelphia; pliers 1,121

Power Metallurgists Debate Technique

(CONCLUDED FROM PAGE 35)

bearings for meters, high temperature shear blades and high speed wood working cutting wheels with speeds up to 23,000 r.p.m. Some applications are restricted by the problem of corrosion resistance. Although the carbides proper are resistant to acids this does not hold for the binder. For this reason, inter-granular corrosion phenomena occur readily and in some cases losses in the binder are extreme. In conclusion, Dr. Engle said that the vast amount of data given by him, constitutes only approximately 5 per cent of the information on his materials while 95 per cent of the information is derived from actual operating conditions.

J. Kurz of the Callite Tungsten Corp. concluded the session with a brief but interesting paper on the development of a substitute for nickel wires used today in the radio tube and incandescent lamp industries. Based on electric research, it was found that iron-molybdenum compositions would come closest to the nickel. However, all attempts of making wires from cast iron-molybdenum compositions containing more than 5 per cent Mo failed completely. The coarse granular metal could only be worked down to wire size with great difficulties for low Mo contents.

The author introduced a series of tests to investigate mechanical working methods on metal powder compositions; 200 mesh powder mixtures containing 5, 10, 15 and 20 per cent Mo, 1 per cent Cu and balance electrolytic iron, were compressed and sintered at 1200 deg. C. for 1 hr. in hydrogen. A parallel series of specimens was prepared by melting in a high refractory furnace. This second set was also subjected to a heat treatment at 1200 deg. C. for 1 hr.

The powder metal ingots showed a grain size considerably smaller than in the case of the cast metals. No precipitation of the intermetallic compound Fe_3Mo_2 was observed in the sintered alloys up to 15 per cent Mo content, and little precipitate was noticed in the 20 per cent Mo composition. On the other hand, the cast alloys already disclosed some precipitate in the 5 per cent Mo composition, and from 10 per cent Mo on precipitation was abundant. Cold working experiments were in close agreement with these observations, and sintered alloys including the 15 per cent Mo combination could readily be worked down to wire size. The chemical analysis of the powder metallurgy method alloy duplicated the cast alloy method exactly. Density values for the alloys made by powder metallurgy were from 7.49 to 8.03, while cast alloy ranged from 8.01 to 8.06. Shrinkage for the powder metallurgy alloy was 21.6 to 16.8 while cast metal ranged from 53.2 to 45.2.

In conclusion, Mr. Kurz predicted a bright future for these new alloy wires, especially since their coefficient of expansion is within the range of glass and close to the Corning 1G type.

During the course of the discussion, the question of the use of such material as a resistor wire was asked. However, such an application appears improbable in view of the high rate of oxidation of molybdenum at elevated temperatures.

Electric Furnaces Near New Record

• • • Total output of electric furnace steels during 1941, most of which is being used for defense purposes, probably will establish a new record of not far from 3,000,000 net tons, the American Iron and Steel Institute estimates. That tonnage is more than three times the total production of electric furnace steels in the four-year period 1915-1918, and fully thirteen times the average annual output during the first World War.

As recently as December 31 1939, the total rated capacity of the industry's electric furnaces was less than 1,900,000 tons of steel per year.

Close estimates of the production of alloy steels this year are not yet available. The industry's capacity for producing alloy steels, however, is now above 8,000,000 tons per year, and actual production this year will probably not be far from that figure.

By comparison, alloy steel production averaged only 1,550,000 tons per year from 1915 through 1918.

Needle in a Haystack

• • • The British Purchasing Commission would like to place a contract with a gear manufacturer who has available a Gleason sunken head gear planer. This machine has been out of production a good many years but is the only type that will cut a set of miter gears of special tooth form desired by the British. Will the owner of such equipment please communicate with THE IRON AGE?

William Beye, Official Of U. S. Steel Corp., Dies

Pittsburgh

• • • **William Beye,** vice-president of United States Steel Corp., in charge of industrial relations, died at his home here early this week. He was 60 years old and had been suffering for some time with a heart malady.

Mr. Beye practiced law in Chicago from 1904 to 1937 as a member of the firm of Knapp, Beye, Allen and Cushing. On Oct. 1, 1937, he succeeded A. H. Young as vice-president of the parent United States Steel Corp., in charge of industrial relations, and a year later he took over similar duties with the United States Steel Corp. of Delaware. He was the author of the Illinois compensation act.

At the time of his death, Mr. Beye was actively engaged in endeavoring to settle the captive coal mine strike. He also took an active role in negotiations leading up to the signing of the SWOC-U. S. Steel labor agreement.

Structural Shipments Rise in September

• • • **Shipments** of fabricated structural steel during September were the second largest this year, according to American Institute of Steel Construction. The new business booked in September amounted to 153,168 tons and compared with a monthly average to date this calendar year of 201,887 tons. The shipments of fabricated structural steel during September amounted to 199,200 tons and compared with the monthly average of 183,878 tons.

Warehouses Can Extend Orders Higher Than A-9

Washington

• • • **Warehouses** receiving ratings higher than A-9 on orders from individual customers may extend these ratings to their suppliers in order to obtain more prompt delivery on the materials. This explanation was made to THE IRON AGE by J. R. Stuart, OPM Iron and Steel Branch.

"However, it is impractical to extend ratings on very small quantities of steel," said Mr. Stuart. "A producer is not required to disrupt his rolling schedule in order to service a high rating on a small quantity of steel."

PERSONALS . . .

• **A. P. Fontaine** has been made chief engineer of the engineering and development department of Vultee Aircraft, Inc., Vultee Field, Cal., succeeding **E. G. Bruce,** who has been appointed chief research engineer. Mr. Fontaine was project engineer for Seversky, where he assisted in developing the P-47 pursuit plane before joining Stinson. When Vultee acquired the Stinson holding, he was made chief engineer of the Wayne, Mich., plant, where he recently completed development of the Model 76 Stinson Sentinel. Mr. Bruce will direct all aerodynamic, structural and general research.

• **Lewis Compton** has been named executive assistant to the president of the National Council of American Shipbuilders, New York. Mr. Compton, a former Assistant Secretary of the Navy, played an important part in the development of the naval expansion program. He recently resigned as finance commissioner of the State of New Jersey to accept this appointment.

• **George V. Mea** has been promoted to manager of the farm and industrial equipment office of International Harvester Co. in Buffalo to succeed **Henry W. Martin** who was made manager of the Albany branch. Mr. Mea will have charge of sales in 10 counties in upstate New York and two in Pennsylvania. He formerly was assistant branch manager in Harrisburg, Pa.

• **Bruce R. Prentice** has been promoted to engineer, aeronautics equipment division of the General Electric Co., Schenectady. Mr. Prentice entered the employ of General Electric as a student engineer on the test course after graduated from the Kansas State College in 1930. He worked on aircraft armament controls in the aeronautics division until his recent appointment. **Kenneth K. Bowman** has been named assistant engineer of the aeronautics division and **Harley H. Bixler** has been appointed mechanical engineer on special assignments.

• **Chester H. Lang** has been elected vice-president in charge of defense activities of the new apparatus department set up by the General Electric Co., Schenectady. He will continue as manager of apparatus sales. Four other vice-presidents were named to staff the new department. They are **David C. Prince,** in charge of application engineering; **Earl O. Shreve,** in charge of commercial activities; **Elmer D. Spicer,** manufacturing, and **Harry A. Winne,** design engineering.

• **Herbert S. Greene** has been promoted to wholesale manager of the White Motor Co. in Buffalo. He replaces **Edward S. Hoke** who has been made manager of the company's Albany branch. Mr. Hoke was wholesale manager at Buffalo since 1939 and Mr. Greene was formerly wholesale manager in Utica.

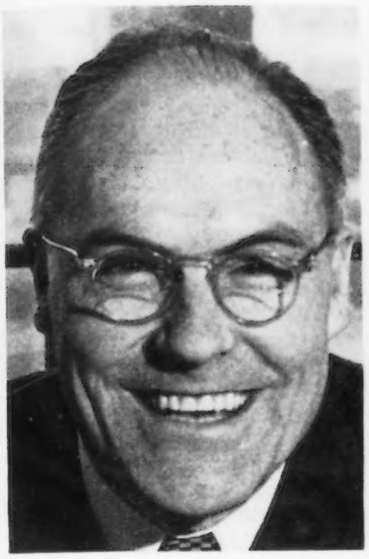
• **J. V. Freeman** has been appointed assistant to the vice-president in charge of coke by-product sales of all subsidiary companies of the United States Steel Corp. of Delaware. Mr. Freeman's office is at 71 Broadway, New York. Beginning his career with the corporation as coke inspector at Gary, W. Va., in 1908, Mr. Freeman was later transferred to Joliet, Ill., during the construction of the Joliet by-product coke ovens of the Illinois Steel Co. In 1910 he became chief chemist of the Central Coal Research Laboratory at Joliet where he remained until 1925 at which time he was transferred to the New York offices of the corporation as assistant in the technical and by-product sales department.

J. V. FREEMAN, assistant to the vice-president in charge of coke by-product sales, United States Steel Corp. subsidiaries.

C. H. LANG

• **H. F. Robertson** has been appointed district manager of the New England office and warehouse of Jessop Steel Co., Washington, Pa., with headquarters at Hartford, Conn., succeeding the late Hugh A. Scallen. **J. W. Stranahan,** formerly Cleveland representative has been transferred to the Philadelphia office. **Paul R. Wendt,** formerly of the Cleveland office also, is now at the Toronto office and **H. Preston Berry** has been transferred from the plant in Washington, Pa., to do special sales work from the Chicago office.

• **Philip C. Rosenthal** has joined the research staff of Battelle Memorial Institute, Columbus, Ohio. He will direct investigations in metallurgy, particularly the foundry practice of gray cast iron. Prior to his association with Battelle, Mr. Rosenthal was for four years on the faculty of the department of metallurgy, University of Wisconsin, from which school he received degrees of B.S. and M.S. in metallurgical engineering.



D. C. PRINCE

E. D. SPICER

H. A. WINNE

• **George J. Higgins,** heretofore acting director and associate professor, has been appointed full professor and director of the department of aeronautical engineering of the University of Detroit. Prior to his appointment to the University faculty, Professor Higgins had been associate aeronautical engineer in the National Advisory Committee for Aeronautics and was in charge of the variable density wind tunnel at Langley Field.

• **Fred C. Wood** has been appointed manager of the air conditioning department of the York Ice Machinery Corp., York, Pa. Born in Hamilton, Ohio, in 1905, he was graduated with a degree in mechanical engineering from Cornell University and entered the York Ice Machinery Corp. as a student engineer in 1928. In 1931 he was transferred to the Westerlin & Campbell Co. a York branch in the Midwest.

Anker Winther, assistant general sales manager of the York Ice Machinery Corp., will supervise the activities of the new advertising and sales promotion department recently established in York, Pa. **Frank Chalmers,** who formerly handled advertising exclusively, has been transferred to York and will participate in sales promotion functions as well.

J. L. Rosenmiller has been named to head the newly created accessory equipment and maintenance department. Mr. Rosenmiller, who was graduated from Lehigh University as a mining engineer, has been manager of the sales promotion division of the company for 11 years.

• **J. F. Eckel** has been named supervisor of General Electric's subcontracting program. In his new post, Mr. Eckel heads up the direction of G-E's subcontracting policies and practices, as set up by company officials, handling relations with subcontractors as well as interested defense officials. Mr. Eckel had for 17 years been engaged in cost work in various departments of the company and since 1939 in subcontracting of refrigerator parts.

J. F. ECKEL, supervisor of subcontracting, General Electric Co.

• **Paul T. Farrell,** purchasing director, Great Lakes Steel Corp., Detroit, has been inducted as president of the Purchasing Agents Association of Detroit. Others serving this year as officers are **C. I. Renwick** of Bruce Products Corp., first vice-president; **B. W. Johnson,** R. C. Mahon Co., second vice-president; and **R. M. Parkin,** Charles A. Strelinger Co. treasurer.

• **A. W. S. Herrington,** president of the Marmon-Herrington Co., Inc., Indianapolis, has been chosen national president of the Society of Automotive Engineers for 1942. Previously he has been chairman of SAE sections at Washington, Baltimore and Indianapolis.

• **Walter J. Conlon,** associated with the Norge division of Borg-Warner Corp. since 1930, has been appointed resident engineer at the Norge plant in Muskegon Heights, Mich., succeeding **Albert F. Koch** who has been transferred to a Borg-Warner plant in Detroit.

• **E. A. Earle,** resigned recently as general manager of the Howell (Mich.) plant of the Arrowhead Steel Products Co. to become asso-

ciated as an executive of a cartridge plant at St. Louis.

• **Alex Taub,** former director of power plant engineering for Vauxhall Motors, General Motors subsidiary in England from 1936 to 1941, and previous to that engine designer for Chevrolet Motor Car Co. and associated with Ford Motor Co. and Packard, has been named as special consultant to assist on technical problems involved in the program to spread defense work and alleviate effects of unemployment caused by application of priorities. Mr. Taub has been technical consultant to the OPM automotive section since July, and previous to that represented the British government in Washington in a technical capacity.

• **Carl L. Wallfred** has been named to the technical staff of the division of process-metallurgy research at Battelle Memorial Institute, Columbus, Ohio. A graduate of the University of Minnesota, Mr. Wallfred has had 20 years experience in chemical and metallurgical research with the U. S. Bureau of Mines, the Northwest Research Foundation and Mines Experiment Station of the University of Minnesota, the Minnesota Mining & Manufacturing Co., and the A. O. Smith Corp.

• **William H. Roberts, Jr.,** secretary and sales manager of S. L. Allen & Co., Inc., is the new president of Farm Equipment Institute. **Frank Silloway,** vice-president of John Deere & Co., has been elected new chairman of the executive committee.

• **Dr. Arthur Newell Talbot,** professor emeritus of the University of Illinois, was honored by the American Railway Engineering Association in recognition of his nearly 30 years of outstanding research for the railroads. A bronze tablet was presented to the university for erection in the laboratory bearing his name. This occasion marked the retirement of Dr. Talbot as chairman of the association's special committee on stresses in railroad track.

• **R. M. Cundiff** has been appointed manager of the Cincinnati branch office, 2512 Carew Tower Building, of the Bailey Meter Co., Cleveland. He succeeds E. R. Dearborn, former manager who resigned Aug. 1. Mr. Cundiff, who is a mechanical engineering graduate of the University of Kentucky, has for the past 12 years been located in the company's New York branch office.

• **John R. Keeler** has been named to the technical staff of Battelle Memorial Institute, Columbus, Ohio. A graduate in chemistry of Indiana University, he was formerly associated with the International Smelting & Refining Co.

• **Harlan A. Messner** has been appointed sales manager of the Ohio Crankshaft Co., Cleveland, and transferred from Cleveland to the West Coast to head district sales and service of Tocco electrical induction hardening and heating equipment.

• **C. C. Swift** who has been secretary and treasurer of the Ohio Machine Tool Co., Kenton, Ohio, since 1911, has been elected president of company succeeding the late Walter D. Sayle.

OBITUARY . . .

• **Ford R. Lamb,** executive secretary of the American Society of Tool Engineers, Detroit, died at his home at Pinckney, Mich., on Oct. 26, following an operation two months ago. A charter member of the society, he had been national president in 1936-37 and at the end of his term became executive secretary. To him goes much of the credit for the success of Machine & Tool Progress Exhibitions held in 1938, 1939 and 1941. Prior to his society connection he represented the Modern Tool Works in the Detroit area and ran a tool shop of his own. At one time he taught tool designing and tool engineering and was the inventor of a stud setter widely used in industry.

THE LATE Ford R. Lamb, executive secretary of the American Society of Tool Engineers.

• **Louis J. Rohling,** Detroit industrial engineer, died recently in his hotel room in Chicago. Born in St. Louis 47 years ago, Mr. Rohling attended Washington University. He went to Detroit 24 years ago with the old Paige Motor Co. Later he was a consulting engineer. Seven months ago Mr. Rohling became associated with Armstrong Mfg. Co., Chicago.

• **Herbert Spencer Salmon,** member of the engineering firm of Salmon & Cowin, Inc., died at his home in Birmingham Oct. 14, aged 53 years. A native of Frankfort, Ind., Mr. Salmon became associated with the Tennessee Coal, Iron & Railroad Co. in 1907 and remained with the Tennessee company until 1922 when he went with Woodward Iron Co. as chief mining engineer. In 1924 he became a member of Salmon & Cowin, Inc. Mr. Salmon was chairman of the Bituminous Coal Board of District No. 13 and since 1935 had been president of Alabama Coals, Inc.

• **Edward Redmond,** vice-president, treasurer and half-owner of the Jackson Fence Co., Jackson, Mich., died Oct. 14, aged 64 years. Mr. Redmond also was organizer of a brick and lime company in Spokane, Wash., and was associated with the Michigan Molded Plastics Co., of Dexter, Mich., and Peninsular Cement Co., Jackson.

• **Leon L. Biche,** sales manager of the power transformer section of the Pittsfield works of the General Electric Co., died suddenly at his home in that city, Friday, Oct. 24. He was 53 years old.

Simplification of Shapes Announced by OPM

• • • **Simplification** of structural steel shapes, effective Feb. 1, 1941, has been announced by OPM in an effort to avoid tying up mills with small miscellaneous rollings for odd sized beams, channels and angles which are comparatively infrequently used.

All shapes regularly used in ship, car and building construction are retained. The number of angle shapes will be reduced 50 per cent by the action, and beams, channels and other shapes ordinarily used in various types of steel construction almost as much.

The accompanying chart explains the simplification. The action was taken in the form of a request to producers by A. D. Whiteside, chief of the OPM iron and steel section after consultation with various authorities.

SIMPLIFICATION OF STRUCTURAL STEEL SHAPES
(Revised as of 9-29-41)
This list is effective from Feb. 1, 1942.

Nominal Dimensions	Weight per Foot	Nominal Dimensions	Weight per Foot
WIDE FLANGE BEAMS			
36 x 16-1/2	300 280 260 240 230	14 x 16	426 398 370 342 320
36 x 12	194 182 170 160 150		314 287 264 246 228
33 x 15-3/4	220 200		211 193 176 158 142
33 x 11-1/2	152 141 132 125	14 x 14-1/2	136 119 103 95 87
30 x 15	210 190 172	14 x 12	84 78
30 x 10-1/2	124 116 108	14 x 10	74 68 61
27 x 14	163 145	14 x 8	53 48 43
27 x 10	106 98 91	14 x 6-3/4	38 34 30
24 x 14	150 130	12 x 12	190 161 133 106 92
24 x 12	120 100		79 72 65
24 x 9	87 80 74	12 x 10	58 53
21 x 13	132 112	12 x 8	45 40
21 x 9	96 82	12 x 6-1/2	36 28 25
21 x 8-1/4	73 68 63 59	10 x 10	112 100 89 77 66
18 x 11-3/4	114 105 96		54 49
18 x 8-3/4	85 77 70 64	10 x 8	41 33
18 x 7-1/2	55 50	10 x 5-3/4	26 21
16 x 11-1/2	96 88	8 x 8	67 58 48 40 35 31
16 x 8-1/2	78 71 64 58	8 x 6-1/2	27 24
16 x 7	50 45 40 36	8 x 5-1/4	21 17
LIGHT BEAMS		**STANCHIONS**	
12 x 4	22 19 16-1/2	6 x 6	27-1/2 25 22-1/2 20 18
10 x 4	19 17 15		15-1/2
8 x 4	15 13	5 x 5	18-1/2 16 13-1/2
6 x 4	16 12	4 x 4	13 10
JOISTS		**H-BEAMS**	
12 x 4	14	8 x 8	34.3
10 x 4	11-1/2	6 x 6	25
8 x 4	10	6 x 6	20
6 x 4	8-1/2	5 x 5	18.9
* **JUNIOR BEAMS**		**SUBWAY COLUMNS**	
12 x 3	11.8		
11 x 2-7/8	10.3	5-3/4 x 9-1/2	40
10 x 2-3/4	9.0	**BEARING PILES**	
9 x 2-3/8	7.5		
8 x 2-1/4	6.5	14 x 14-1/2	117 102 89 73
7 x 2-1/8	5.5	12 x 12	74 53
6 x 1-7/8	4.4	10 x 10	57 42
		8 x 8	36

*Rolled by Jones & Laughlin Steel Corp.

Canadian Contracts Now Over $2 Billion Mark

Ottawa

• • • **Total value** of contracts awarded and commitments made by the Department of Munitions and Supply and its predecessors for the period from July 14, 1939, to Sept. 30, 1940, was $2,578,186,766. Contracts placed on Canadian account totaled $1,530,290,087. The aggregate of orders for stores placed on United Kingdom account was $751,872,000. Contracts awarded on other accounts totaled $80,235,679. Compared with the above figures in the last World War, 1914 to 1918, Canada's total expenditure was approximately $1,025,000.

More than 180,000 contracts have been placed on Canadian account of an average value exceeding $8,300.

Some of the purchases on Canadian account from July 14, 1939, to Sept. 30, 1941, are classified by commodity groups as follows:

Aircraft	$319,596,699
Alloys and metals	5,338,133
Construction and defense projects	121,333,375
Instruments	20,948,595
Land transport	103,194,592
Machinery	13,741,414
Munitions	53,253,793
Ordnance	212,018,180
Shipbuilding	219,115,197
Tools	3,296,340

U. S. Steel Corp. Reports Quarter Profit, $34 Million

• • • **United States Steel Corp.** reports for the third quarter of 1941 net profit of $34,313,345, after interest, depreciation and taxes, compared with profit of $24,814,751 for the second period this year. Finished steel shipments for the third quarter totaled 5,084,557 net tons compared with 5,101,606 tons in the second period. Gross income from operations for the third period was $122,788,342 while the corporation's total payroll totaled $156,470,085. Net earnings for third quarter were $3.21 a common share compared with $2.12 for the second quarter.

Youngstown Contract Distribution Office Opened

Washington

• • • **A new field office for** OPM's contract distribution division has been opened in Youngstown, Ohio, bringing the total number of such regional offices to 54. Such offices are designed to help qualified manufacturers, particularly small companies, by providing assistance on procurement, engineering and financial problems.

The Division also has named as its director for the State of Maine, Herbert Payson, who has been connected with the shipbuilding and machine tool industries for a number of years.

CONSTRUCTION STEEL

. . . STRUCTURAL STEEL, REINFORCING BARS, PLATES, PILING, ETC.

Fabricated Steel

Lettings drop to 13,925 tons from 25,500 tons last week; new projects of 10,655 tons compare with 32,500 tons; plate awards total 15,015 tons.

NORTH ATLANTIC STATES

AWARDS

1500 Tons, Tonawanda Township, N. Y., airplane motors testing building for Chevrolet Motor Division, to Bethlehem Steel Co., Buffalo, through Darron & Armstrong Co., Inc., Detroit, general contractor.

386 Tons, Lancaster, Pa., state highway bridge, to Bethlehem Steel Co., Bethlehem, Pa.

341 Tons, Portland, Me., two piers for Bancroft & Martin Rolling Mills Co., to American Bridge Co., Pittsburgh.

255 Tons, Southfields, N. Y., State highway bridge RC-41-43, to American Bridge Co., Pittsburgh.

220 Tons, Harpursville, N. Y., tower bracing bridge for Delaware & Hudson Railroad, to American Bridge Co., Pittsburgh.

170 Tons, Everett, Mass., Boston Edison Co. turbine pedestals to American Bridge Co., Pittsburgh, Pa.

145 Tons, Rockaway Park, N. Y., pumping plant, to Jones & Laughlin Steel Corp., Pittsburgh.

105 Tons, Tonawanda Township, N. Y., plant addition for Farrel-Birmingham Co., Inc., to R. S. McMannus Steel Construction Co., Inc., Buffalo, through Howard F. Stimm Co., Inc., Buffalo, general contractor.

THE SOUTH

2850 Tons, Louisville, Ky., general assembly shops for Defense Plant Corp., to American Bridge Co., Pittsburgh.

1102 Tons, Kentucky Dam, Ky., power house for TVA, to Bethlehem Steel Co., Bethlehem, Pa.

976 Tons, Tyner, Tenn., ordnance works power house, to Duffin Iron Co., Chicago.

340 Tons, Gilbertsville, Ky., TVA spillway bridge, to Worden-Allen Co., Milwaukee.

120 Tons, Gadsden, Ala., five heat treating buildings for Gadsden ordnance plant, to Southern Steel Works Co., Birmingham.

CENTRAL STATES

1350 Tons, Canton, Ohio, steel plant extensions for Republic Steel Corp., to an unnamed fabricator.

830 Tons, Cleveland, extension for Aluminum Co. of America, to Pittsburgh Bridge & Iron Co., Pittsburgh.

560 Tons, Austin, Ind., Morgan Packing Co. building, to Central States Bridge & Structural Co., Indianapolis.

346 Tons, Chicago, Leavitt Street bridges for Grand Trunk Western Railroad, to American Bridge Co., Pittsburgh.

216 Tons, Cherokee and Crawford Counties, Kan., State highway bridge, to St. Joseph Structural Steel Co., St. Louis.

140 Tons, Wood River, Ill., boiler supports for Shell Oil Corp., to American Bridge Co., Pittsburgh.

PENDING STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

5500 Tons, Brooklyn Navy Yard, ordnance machine shop.

535 Tons, Saratoga and Rensselaer Counties, N. Y., Hudson River State bridge.

430 Tons, Waterbury, Conn., manufacturing building for Vickers, Inc.

245 Tons, Stamford, Conn., building for Union Wire Die Corp.

170 Tons, Bridgeport, Conn., casting shop extension for Bridgeport Brass Co.

130 Tons, Albany, N. Y., reconstruction bridge No. 352-B for New York Central Railroad Co.

THE SOUTH

280 Tons, Dallas, Tex., turbine room extension for Dallas Power & Light Co.

230 Tons, Ducktown and Farmer, Tenn., operating bridges over spillways for TVA.

CENTRAL STATES

290 Tons, Soelch, Wis., State overhead bridge FAP 4670B-(2).

275 Tons, Detroit, building for American Metal Products Co.

186 Tons, Sparta, Wis., State bridge FAP-398-B-(1).

145 Tons, Cincinnati, factory building, St. Bernard, for Emery Industries.

WESTERN STATES

1020 Tons, Mare Island Navy Yard, ship fitter's shop.

1000 Tons, Kodiak Island, Alaska, military project; Siems-Drake-Puget Sound, Seattle, contractor.

220 Tons, Bremerton, Wash., Navy Yard forge shop.

WESTERN STATES

873 Tons, Torrance, Cal., forge and machine shop for National Supply Plant Corp., to Pacific Iron & Steel Co., Los Angeles.

298 Tons, Bremerton, Wash., Puget Sound Navy Yard building extension, to Midwest Steel & Iron Co., Denver.

280 Tons, Seattle, oil storage for Bethlehem Steel Co.; fabricated by self.

200 Tons, Seattle, Army quartermaster, to Pacific Car & Foundry Co., Seattle.

FABRICATED PLATES

AWARDS

10,415 Tons, Brooklyn Navy Yard, fabricated cylinders, etc., to Chicago Bridge & Iron Co., Chicago.

2400 Tons, Las Vegas, Nev., Basic Refractories, Inc., magnesium plant, to Western Pipe & Steel Co., Los Angeles.

2000 Tons, Seattle, 74 tanks for United States Engineer, to James G. Heggie Co., Joliet, Ill.

200 Tons, Santa Ana, Cal., elevated water tank (Invitation 76), to Darby Corp., Kansas City, Kan.

PENDING PROJECTS

1150 Tons, Coram, Cal., conduit liners for Shasta Dam river outlets (Specification 998); bids in.

675 Tons, Mare Island, Cal., 215 Navy mooring buoys; bids in.

STEEL PILING

AWARDS

1500 Tons, East Chicago, Ind., Socony Vacuum Oil Co., to Inland Steel Co., Chicago.

Cast Iron Pipe

Junction City, Kan., will take bids soon for pipe lines for water system extensions and other waterworks installation. Cost about $75,000.

Hooks, Tex., plans pipe lines for water system and other waterworks installation, including reservoir and purification plant. Fund of about $494,500 is being arranged through Federal aid for this and sewage system. Rollins & Forrest, Praetorian Building, Dallas, Tex., are consulting engineers.

City Commission, Muskegon, Mich., plans pipe line extensions in water system in several city areas where service is not available at present time, including main lines and distribution branches. Cost about $250,000. Financing is being arranged through Federal aid.

Metropolitan Utilities District, Eighteenth and Harney Streets, Omaha, Neb., plans extensions in water pipe lines, including main lines to Fort Crook army station and new aircraft-manufacturing plant of government in that area, now in course of construction, as well as residential area between city and Fort Crook, totaling about six miles. Cost about $300,000. Financing is being arranged through Federal aid.

General Purchasing Officer, Panama Canal, Washington, asks bids until Nov. 4 for 25 sections of cast iron pipe, each section 16 ft. long (Schedule 5654).

San Diego, Cal., has awarded 5600 ft. of 12-in. and 300 ft. of 10-in. pipe to United States Pipe & Foundry Co., San Francisco.

Hermiston, Ore., plans pipe line extensions and replacements in water system; also drilling of new well, installation of pumping machinery and other waterworks improvements. Cost about $96,134. Fund in that amount has been secured through Federal aid.

Public Utility District No. 1 of Wahkiakum County, Cathlamet, Wash., will take bids Nov. 10 for a domestic water supply system requiring 87,000 ft. of 2, 4, 6 and 8-in. pipe and miscellaneous fittings.

Pipe Lines

Shell Pipe Line Corp., Shell Building, Houston, Tex., affiliated with Shell Oil Co., Inc., has let contract to Permian Basin Construction Co., Odessa, Tex., for new 6-in. welded steel pipe line from Westbrook to Big Spring, Tex., about 26 miles, for crude oil transmission. Connection will be made with Cosden refinery at latter place. Cost over $75,000.

United States Engineer Office, Vicksburg, Miss., asks bids until Nov. 3 for 10 sections of 16-in. inside diameter steel pipe, each section 30 ft. long (Circular 35).

Metropolitan Utilities District, Eighteenth and Harney Streets, Omaha, Neb., plans extensions in pressure pipe line system for gas supply in districts Nos. 918 and 925, recently created; also will extend cast iron mains for water service in districts Nos. 1664, 1667 and 1668, recently established.

United States Engineer Office, Mobile, Ala., has let contract to Brown & Root, Inc., Masonic Temple Building, New Orleans, for welded steel pipe line for natural gas transmission at Keeler Field aviation mechanics training school, Biloxi, Miss., at $52,927.

Republic Light, Heat & Power Co., Jackson Building, Buffalo, plans extensions and replacements in pressure pipe lines for natural gas transmission and distribution in various parts of company territory.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Nov. 6 for steel pipe, steel tubing and wrought iron pipe, for yard at Bayonne, N. J. (Schedule 9193).

Oklahoma Natural Gas Co., 624 South Boston Street, Tulsa, Okla., plans extensions in pressure pipe line system for natural gas transmission to new aircraft assembling plant of government, north of city limits, now in course of construction, and thence to towns of Skiatook and Sperry, where gas will be furnished. Distribution lines will be installed at three points noted, with control stations and other operating facilities.

War Dept. Will Build $14 Million Tank Armor Plant

Granite City, Ill.

• • • **The War Department** will build a $14,000,000 plant for production of tank armor, to be operated by General Steel Castings Corp., at Granite City, Ill. The cost of land and buildings will be $3,268,000 and of machinery and equipment $10,731,600.

Reinforcing Steel

Awards of 6100 tons; 12,600 tons in new projects.

AWARDS

ATLANTIC STATES

300 Tons, Long Island City, N. Y., Pepsi-Cola building, to Republic Steel Corp., Cleveland.

200 Tons, Baltimore, tube mill, Revere Copper & Brass Co., to Bethlehem Steel Co., Bethlehem, Pa.; James Stewart Co., contractor.

160 Tons, Portsmouth, N. H., Navy Yard prison building remodeling, to Truscon Steel Co., Boston.

150 Tons, Belleville, N. J., Isolantite, Inc., plant, to Bethlehem Steel Co., Bethlehem, Pa.; John W. Ryan Co., contractor.

140 Tons, Bradford County, Pa., highway project R-212, section 12, to Bethlehem Steel Co., Bethlehem, Pa.; A. B. Cole, contractor.

THE SOUTH

800 Tons, Elizabeth City, N. C., Navy lighter than air base, to Jones & Laughlin Steel Corp., Pittsburgh; J. A. Jones Construction Co., Charlotte, N. C., contractor.

413 Tons, Volusia, Fla., Steel Products Co. project FAP-117-A, to Truscon Steel Co., Youngstown.

205 Tons, Portsmouth, Va., Norfolk Navy Yard requisition 453-NSAF, to Truscon Steel Co., Youngstown.

200 Tons, Morgantown, W. Va., du Pont ordnance plant, to Republic Steel Corp., Cleveland.

CENTRAL STATES

900 Tons, Columbus, Ohio, warehouse No. 13, U. S. Army General Depot, to Jones & Laughlin Steel Corp., Pittsburgh; Corbetta Construction Co., contractor.

750 Tons, Sandusky, Ohio, Plum Brook ordnance works, to Jones & Laughlin Steel Corp., Pittsburgh, and Republic Steel Corp., Cleveland, through Builders Structural Steel Co., Cleveland.

700 Tons, Moraine, Ohio, General Motors Corp. Frigidaire division, superstructure, plant No. 2, to Pollak Steel Co.; Industrial Building Co., contractor.

260 Tons, Weldon Springs, Mo., ordnance plant addition, to Truscon Steel Co., Youngstown.

250 Tons, Wright Field, Ohio, armament laboratory building, to Pollak Steel Co., Cincinnati; F. Messer & Son, contractors.

200 Tons, Centralia, Ill., hotel, to Olney J. Dean Co., Chicago.

200 Tons, Weldon Springs, Mo., ordnance plant, to Truscon Steel Co., Youngstown, through Fraser Brace Engineering Co.

150 Tons, Hammond, Ind., water intake, to Joseph T. Ryerson & Sons.

120 Tons, Dubuque, Iowa, Dubuque Packing Co. plant, to Bethlehem Steel Co., Bethlehem, Pa.

PENDING REINFORCING BAR PROJECTS

ATLANTIC STATES

1000 Tons, Pottstown, Pa., Jacobs Aircraft Engine Co. plant.

800 Tons, New London, Conn., additional submarine base facilities.

400 Tons, Pennhurts, Pa., State school buildings.

300 Tons, Boston, switching station, Boston Edison Co.

250 Tons, Springfield, Mass., service building, Armory.

250 Tons, Camden, N. J., three shipways for New York Shipbuilding Corp.

THE SOUTH

400 Tons, Fairmont, W. Va., Westinghouse Electric & Mfg. Co. plant.

CENTRAL STATES

1200 Tons, Fairfield, Ohio, maintenance command building at Patterson Field; bids Oct. 31.

1000 Tons, Milwaukee, Allis-Chalmers supercharger plant.

200 Tons, Lima, Ohio, Westinghouse Electric & Mfg. Co. plant.

200 Tons, Chicago, Shite Cap Co. building.

Weekly Bookings of Construction Steel

Week Ended →	Oct. 28, 1941	Oct. 21, 1941	Sept. 30, 1941	Oct. 29, 1940	Year to Date 1941	Year to Date 1940
Fabricated structural steel awards	13,925	25,500	17,700	39,925	1,123,120	953,811
Fabricated plate awards	15,015	200	590	2,360	120,640	125,930
Sheet steel piling awards	1,500	0	0	1,435	26,760	65,005
Reinforcing bar awards	6,100	13,250	38,125	8,950	628,730	397,310
Total letting of Construction Steel	36,540	38,950	56,415	52,670	1,899,250	1,542,056

WESTERN STATES

3007 Tons, Coram, Cal., Shasta Dam (Invitation A-33,457-A); bids Nov. 4.

700 Tons, Burbank, Cal., Vega Airplane Co. buildings 62 and 80.

687 Tons, San Francisco, United States Engineer, for Wheeler Field, T. H.; bids in.

500 Tons, San Diego, Cal., vehicular overpass at Consolidated Aircraft Corp.

180 Tons, Friant, Cal., Friant Dam (Invitation 48,893-A); bids in.

BRITISH WEST INDIES

1500 Tons, Trinidad, Naval air base.

Army Awards 29 U.S.O. Camp Center Contracts

• • • **The Army Quartermaster** Corps announced Oct. 24 that contracts had been awarded for 29 United Service Organization recreation buildings. Most of the new structures, to be situated at Army camps in ten states, will be of frame construction, a few of brick, and they will vary in cost from $39,685 to $87,400. These are the first awards of the kind to be announced.

The Government has been widely criticized for its delay in building the recreation centers, which will be managed by the USO with funds collected in campaigns of last winter and spring.

National Bronze Buys Plant From Industrial Brownhoist

Cleveland

• • • **National Bronze & Aluminum** Foundry Co., whose plant was demolished in a $2,250,000 fire, has acquired the former Cleveland plant of the Industrial Brownhoist Corp. National Bronze has been operating in renovated buildings at its damaged plant, where nearly all of the company's 1100 employees are working three shifts a day. The company makes aluminum castings for tanks, airplanes, diesel engines, searchlights and gun mounts.

Labor Bottleneck Shown In Drop Forging Survey

Cleveland

• • • **A recent survey** taken by the Drop Forging Association, Cleveland, reveals that plants accounting for 73 per cent of the industry's volume regarded a shortage of labor as their most important bottleneck. This shortage was further intensified by union restrictions retarding training programs by limiting the number of apprentices in relation to journeymen. Moreover, the time involved to train the new men, on the basis of union regulations for length of apprenticeship is another drawback to relieving the employment situation. The report indicates that of 353 apprentices now in training, only 21 would become journeymen by the end of 1941, 125 during 1942 122 during 1943 and 85 in 1944 or later. Since it is estimated that 294 die sinkers are needed at present, the apprenticeship limitations prevent the easing of this bottleneck.

Another union provision that hampers production is restriction covering work on the surface of dies, which must be done by die sinkers or their apprentices. This prevents the performance of work by other employees which actually could be performed by beginners. Since apprentices must serve as such during seven years, it is apparent that union regulations make no provision for a national emergency such as the present one. The International Die Sinkers Conference limits the number of apprentices to one for every journeyman employed.

The information, which was gathered from 107 of the 113 eligible plants for the survey, reveals that lack of production material was the major bottleneck for 19 per cent of the reporting volume.

MACHINE TOOLS

. . . SALES, INQUIRIES AND MARKET NEWS

Automatic Screw Machines Needed Most

Chicago

• • • **Perhaps the best practical** picture of the machine tool situation was revealed at the Defense Production Clinic here last week. Almost every prime contractor listed equipment needed most. At the head of every list were automatic screw machines, followed by vertical turret lathes, grinders, boring mills, gear cutting machines, tools and dies, and gage making facilities. The unanimity of needs for these machines clearly showed that this is where the scarcity lies. In fact, one maker of turret lathes showed up at the clinic looking for subcontractors who could take on turret lathe work.

One prime contractor revealed that he had been waiting eight months for delivery of a large size turret lathe, on a top priority order. His defense work runs into large parts and he could find no one at the clinic capable of taking on the size jobs he had to farm out. Everywhere, little metal plant operators complained that their inability to get in the defense picture was traced to the impossibility of getting machine tools. "There's a shortage in only certain lines of equipment, but the defense subcontracting available must be done on those particular types," they said. "Drill presses," prime contractors stated, "are a drug on the market, but you can't find key equipment for love or money."

August Machinery Exports Exceed July's By 50%

Washington

• • • **Reaching their highest** monthly value since January of this year, United States exports of industrial machinery in August totaled $41,976,614, an increase of more than 50 per cent over the July figure of $27,794,765, according to the Department of Commerce. Gains in exports of metalworking machinery and petroleum equipment contributed principally to the increase. Metal working machinery export figures follow:

	August	*July*
Machine tools	$17,124,342	$9,226,262
Milling machines	4,151,690	2,034,603
Lathes	3,544,183	1,730,327
Drilling machines	1,629,846	528,764
Grinding machines	2,399,030	1,168,936
Other metal working machinery	3,574,584	2,279,740
Rolling mill	543,558	456,542
Forging machinery	979,475	719,161
Sheet & plate equipment	1,558,422	650,128

Motor Deliveries a Problem

Cincinnati

• • • **Management problems continue** to be in the forefront of the problems of machine tool manufacturers. With business continuing to flow into district offices at an almost undiminished rate, production and procurement of materials virtually overshadows all other matters. With plants producing at a rate that a year ago would have been considered fantastic, production managers are continually seeking new ways to increase the output. Former unused corners of plants are now being pressed into service and a constant search for new subcontractors is being maintained. The chief procurement problem has been that of getting motors and while airplane delivery of many items has been resorted to, as well as the employment of men to seek constantly for the necessary materials, no serious delay in shipments from this cause has been reported.

NON-FERROUS METALS

. . . MARKET ACTIVITIES AND PRICE TRENDS

Zinc Dust Prices Adjusted by OPA

• • • **The upward adjustment** of zinc dust prices, in line with similar adjustments in zinc scrap and prime zinc prices was approved this week by the OPA. The new base price in carload lots, drums returned, is 10.35c. a lb., up from 9.5c. per lb. For less than carload shipments, a new price of 11.35c. per lb. f.o.b. shipping point, drums not returned, was made. Other extras for quality are allowed, and for dust produced on the West Coast.

During the period of price adjustment in the zinc industry during the past two weeks, an attempt that met with instant remonstrance by OPA was made by strip and sheet zinc makers to follow the simple process of marking up prices 1c. a lb. OPA officials believe that the differential between sheet and strip zinc is too great, and will probably make the price adjustments themselves.

Reports that production of shell and cartridge cases has been ordered curtailed indefinitely by the War Department was the chief interest in the copper trade this week. It is calculated that by the first of next month operations in copper and brass mills will be curtailed to about 35 to 50 per cent of present output because of this order. Such curtailment is not expected to effect the supply of these materials to the Navy or to Britain. Lack of loading facilities was the reason for curtailment of shell production. Thousands of tons of copper, to say nothing of about 7000 tons of zinc spelter per month could be made available to the production of other important defense items should the Army release this material.

Commenting on published reports that agreements have been concluded between the Treasury Department's Procurement Division and three high-cost Michigan copper producers for the purchase of their output, at higher than ceiling prices, OPA stated that the deal was made with their full knowledge.

Whatever prices may be involved in these agreements, above the 12c. ceiling, were arrived at pursuant to the OPA formula and have full approval of OPA.

St. Joseph Lead Co. announced that its Missouri lead production will be increased by 20 per cent, or about 2600 tons per month, by increasing the work week from five to six days and paying time and one-half for overtime. Increased costs resulting from the payment of overtime will be paid by the company, but it is hoped that OPA will adjust lead prices to cover this cost.

Of the November lead production, 15 per cent will be set aside for allocation in a supplementary order to General Preference Order M-38. It is estimated that this order will set aside from 6000 to 6500 tons of lead for allocation in addition to the amounts allocated by MRC from imported supplies.

Non-Ferrous Prices

(Cents per lb. for early delivery)

Copper, Electrolytic[1]	12.00
Copper, Lake	12.00
Tin, Straits, New York	52.00
Zinc, East St. Louis[2]	8.25
Lead, St. Louis[3]	5.70

[1] Mine producers' quotations only, delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 15c.-17c. a lb.; No. 12 remelt No. 2, standard, 16c. a lb. NICKEL electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt: Asiatic, 16.50c. a lb., New York; American, 13c. a lb., f.o.b. smelter. QUICKSILVER, $195 per flask of 76 lb. BRASS INGOTS, commercial 85-5-5-5, 13.25c. a lb.

SCRAP

. . . MARKET ACTIVITIES AND PRICE TRENDS

Mill Inventories Still are Shrinking

• • • **Shipments** of iron and steel scrap last week continued thin in relation to heavy consumption and inventories at some points sank lower. The situation commanded less public attention, however. The captive coal mine strike and other labor eruptions distracted operating executives and threatened to drag down the very high production schedules set up for this week.

Meanwhile, Washington was assembling mailing lists for the distribution of forms which scrap producers, brokers and consumers must fill out starting Nov. 15 in connection with full priority control over scrap. Affecting thousands of plants and individuals, the order is one of the most sweeping undertaken. It covers so much territory that it's going to be difficult to administer effectively, if only from the standpoint of the number of individual problems involved.

Factors other than scrap shortages frequently are responsible for furnace shutdowns, pointed out Edwin C. Barringer, of the Institute of Scrap Iron and Steel, commenting on the widespread publicity which has occurred in recent weeks when units were taken out of production temporarily. The Lackawanna shutdown of five open hearths was made despite a fair-sized stockpile of scrap, he said. The company countered the assertion with a reiteration of its claim that its supplies are near exhaustion.

"Other circumstances no doubt played a large part in Bethlehem's decision to curtail operations because there is plenty of scrap for all defense needs and for secondary defense needs as well," Mr. Barringer said. "We are trying in every way to get enough scrap for all purposes—defense and civilian—but some readjustment may be necessary without making defense suffer.

"It must be borne in mind that only about 25 per cent of present steel production is going for Army, Navy or lend-lease needs. The remainder is for secondary defense and civilian use. The amount of steel now available for non-defense usage is greater than the entire production of steel in many years of the immediate past.

"Shutting down of open hearth or blast furnaces can result from many causes. Sometimes it is needed repairs, sometimes changing the size and type of production, sometimes because there is not sufficient percentage of defense operation.

"One of the obstacles being encountered in keeping a supply of scrap moving is the direct dealing practice used by some mills and foundries by which regular accredited dealers are by-passed. In this practice, frowned upon by all governmental agencies, the mills or foundries buy directly from producers of scrap, causing dislocation of supply, much cross-hauling, violation of price schedules and degradation of quality. This causes scrap to assume irregular movement and is especially dangerous to continued steel operations in the winter months."

At Buffalo, in reply to the Institute statement, a company spokesman last week reiterated the claim that steel scrap is about exhausted at the plant.

D. Sloan Hurwitz, leading scrap dealer, asserted that the statement by Barringer was "prompted by Buffalo interests that are not fully informed of the Bethlehem situation."

Other scrap dealers at Buffalo were reported "plainly nettled" by the statement. They said the statement came in the midst of a local intensive scrap collection campaign being sponsored by the waste industry here and received wide publicity in the newspapers.

9 Months' Scrap Usage Nearly Equal to All 1940

• • • **Steel mills** and foundries in the first nine months of 1941 consumed 39,858,000 gross tons of iron and steel scrap, according to the Institute of Scrap Iron & Steel, Inc. The total for all 1940 was 41,687,000 tons.

"Notwithstanding the many handicaps placed upon the scrap industry by government control, the fact is that very little actual production of iron and steel has been lost due to shortage of scrap," said Edwin C. Barringer, executive secretary of the Institute.

"There is no doubt that the supply of scrap for primary and secondary defense purposes will be ample. Whether there will be a substantial surplus for non-defense requirements depends upon the success of the various collection programs being pushed.

September consumption was estimated at 4,392,000 gross tons compared with 4,518,000 tons in August and 3,876,000 tons in September, 1940.

Second Scrap Dealer Forced To Make Refunds by OPA

Washington

• • • **Price Administrator** Henderson announced that "another proven violator" of the scrap price schedule, the second instance of the kind, has agreed to refund to purchasers all sums collected in excess of the established ceiling prices since Sept. 2. The case "concerns a relatively small Pennsylvania dealer who admitted several violations." Cases are being prepared against several other violators.

Road Authorized to Sell Rail for Ordnance Plant

St. Louis

• • • **Federal Court** here has authorized the St. Louis-Southwestern Railway to sell 28 track miles of 85-pound relaying rails, and accessories, a total of 3,956 gross tons, at $30 a gross ton, amounting to $118,680. The rail will serve a Government ordnance plant now being constructed at Texarkana, Ark.-Tex.

•

Pittsburgh—At large centers such as Pittsburgh, the amount of scrap going into mills is said to be much less than the amount being consumed, with the result that inventories are becoming smaller and smaller. An actual case occurred in the Pittsburgh district where the timely arrival of one carload of scrap actually prevented the closing down of an electric furnace. This instance is typical of many units whose inventories have been reduced so drastically that maintenance

of output is contingent upon the arrival of cars of scrap. Other plants, however, are receiving less scrap than they are using, with the belief expressed here that the first snow or sleet storm will bring into sharp focus the real situation. At that time, it is believed, the allocation feature of the scrap priority order will get its real test. Complicating the scrap picture generally is the effort of some steel companies to obtain additional supplies because they have had to ship out pig iron from the monthly pool on allocation orders from OPM.

•

Chicago—Mills are resigned to what they regard as inevitable curtailment of operations in a scrap shortage that is getting steadily worse. First instance of a mill losing scrap on allocation took place this week when 30 cars were diverted from a customer here and shipped to a producer in Ohio. High prices being offered by a few scrap-starved mills is shutting off supply to other buyers in certain outlying sections. Washington may be asked to designate additional basing points to counteract some of these isolated cases.

•

Philadelphia—Reports from consumers in the Eastern Pennsylvania area indicate that scrap moved a little more freely this week than during the past several weeks, but is still far below the actual consumption. One furnace that was reported off several weeks ago because of lack of scrap went back into production, but only for as long as sufficient scrap is forthcoming.

•

Cleveland—The reason for the continued high level of the steel operating rate, despite the tightness of the scrap situation, is attributed to the remarkable job of "juggling" of inventories that has been done by the steel mills. This has involved transferring supplies from one plant to another and diverting purchases in abnormal directions for the sake of maintaining operations. OPM is reported to have taken some plant scrap from one of the largest sources in this area for shipment to a Massillon steel plant in order to maintain the operations there. In past weeks this scrap had been going in large part to a Pittsburgh purchaser who normally does not buy scrap in the Cleveland district. At the same time, the OPM has solicited various scrap dealers for tonnages also to be sent to Massillon, Youngstown and Warren.

•

St. Louis—Rains in the southwest have halted the movement of scrap iron to this market. No railroad with headquarters here has issued a list in two weeks. Mills in the district continue to use up their reserves, without affecting production.

•

Cincinnati—With all dealers in the Southern Ohio District adopting an attitude of compliance with Government regulations, the market is without an interesting feature. Dealer scrap is still tight. Production scrap is reported moving better. While no curtailment in steel production because of shortage of scrap is present, steel producers are kept on the edge of their chairs by shifting of allocations with the inevitable feeling among steel producers that they can only operate from day to day.

•

Birmingham—The scrap situation is described in steel circles here as "no better and no worse." As has been the case for months, mills are unable to obtain sufficient material for requirements. Some tonnages are coming in from remote points.

Boston—Turnings, borings, bundled material and breakable cast are moving regularly but heavy melting steel shipments have been retarded by uncertainty in the trade as to what the government expects. Wreckers have made little headway in production of automobile scrap. The Washburn Wire Co., Phillipsdale, R. I., is reported to have a fairly good stock of scrap, but the American Steel & Wire Co., Worcester, Mass., is said to be not so well off.

Iron and Steel Scrap (other than railroad scrap)

(Maximum basing point prices as revised by OPA to Sept. 26, 1941, from which shipping point prices and consumers' delivered prices are to be computed, per gross ton)

Basing Points → / ▼ GRADES	Pittsburgh	Johnstown Wairton Steubenville Youngstown Warren Sharon Canton	Chicago	Kokomo	Bethlehem	Claymont Coatesville Phoenixville Harrisburg	Sparrows Point	Buffalo	Cleveland	Toledo	Cincinnati* Portsmouth Middletown Ashland	St. Louis	Detroit	Duluth Min'apolis**	Birmingham	Chattanooga	Radford, Va.	Worcester Bridgeport Phillipsdale, R. I.	Los Angeles San Francisco Seattle Portland	Minnequa, Colo.
No. 1 heavy melting	$20.00	$20.00	$18.75	$18.25	$18.25	$18.75	$18.75	$19.25	$19.50	.....	$19.50	$17.50	$17.85	$18.00	$17.00	.....	.....	.....	$14.50	$16.50
No. 1 hyd. comp. black sheet	20.00	20.00	18.75	18.25	18.25	18.75	18.75	19.25	19.50	.....	19.50	17.50	17.85	18.00	17.00	.....	.....	.....	14.50	16.50
No. 2 heavy melting	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	(See	13.50	15.50
Dealers' No. 1 bundles	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	16.50	16.85	17.00	16.00	.....	.....	foot-	13.50	15.50
Dealers' No. 2 bundles	18.00	18.00	16.75	16.25	16.25	16.75	16.75	17.25	17.50	.....	17.50	15.50	15.85	16.00	15.00	.....	.....	notes)	12.50	14.50
Mixed borings and turnings	15.25	15.25	14.00	14.25	13.50	14.00	14.00	14.50	14.75	13.10	14.75	12.75	13.10	.....	12.25	.....	.....	.....	9.75	11.75
Machine shop turnings	15.50	15.50	14.25	14.50	13.75	14.25	14.25	14.75	15.00	13.35	15.00	13.00	13.35	15.50	15.00	Alloy, W.Va. 17.60	.....	.....	10.00	12.00
Shoveling turnings	16.50	16.50	15.25	15.50	14.75	15.25	15.25	15.75	16.00	14.35	16.00	14.00	14.35	16.50	.....	.....	.....	.....	11.00	13.00
No. 1 busheling	19.50	19.50	18.25	17.75	17.75	18.25	18.25	18.75	19.00	.....	19.00	17.00	17.35	17.50	16.00	.....	.....	.....	14.00	16.00
No. 2 busheling	15.50	15.50	14.25	13.75	13.75	14.25	14.25	14.75	15.00	.....	15.00	13.00	13.35	13.50	12.50	.....	.....	.....	10.00	12.00
Cast iron borings	15.75	15.75	14.50	14.00	14.00	14.50	14.50	15.00	15.25	13.60	[6]15.25	13.25	13.60	13.75	12.75	.....	.....	.....	10.25	12.25
Uncut structural, plate scrap	19.00	19.00	17.75	17.25	17.25	17.75	17.75	18.25	18.50	.....	18.50	18.50	16.85	17.00	16.00	.....	.....	.....	13.50	15.50
No. 1 cupola	21.00	21.00	20.00	20.00	22.50	23.00	22.00	20.00	22.00	.....	21.00	20.00	20.35	*19.00	20.00	20.50	21.00	22.00	18.00	.....
Heavy breakable cast	19.50	19.50	18.50	18.50	21.00	21.50	21.00	18.50	20.50	.....	19.50	18.50	18.85	*17.50	18.50	.....	.....	20.50	17.00	.....
Stove plate	19.00	[5]19.00	17.00	16.00	18.00	18.50	18.00	19.00	18.00	15.60	17.50	17.00	14.10	*16.00	17.00	17.50	18.00	17.50	14.00	.....
Low phos. billet, bloom crops	25.00	25.00	23.75	23.75	23.25	23.75	23.75	24.25	24.50	.....	23.50	22.50	22.85	23.00	22.00	.....	.....	.....	19.50	.....
Low phos. bar crops, smaller	23.00	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	21.50	20.50	20.85	21.00	20.00	.....	.....	.....	19.50	.....
Low phos. pu'ch'gs, plate scrap[1]	24.75	23.00	21.75	21.75	21.25	21.75	21.75	22.25	22.50	.....	21.50	20.50	20.85	21.00	20.00	.....	.....	.....	17.50	.....
Machinery cast, cupola size[2]	22.00	22.00	21.00	21.00	23.50	24.00	23.50	21.00	23.00	.....	22.00	21.00	21.35	*20.00	21.00	21.50	22.00	23.00	19.00	.....
No. 1 mach. cast, drop-broken, 150 lb. and under	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	.....
Clean auto cast	22.50	22.50	21.50	21.50	24.00	24.50	24.00	21.50	23.50	.....	22.50	21.50	21.85	20.50	21.50	22.00	22.50	23.50	19.50	.....
Punchings and plate scrap[3]	23.75	22.00	20.75	20.75	20.25	20.75	20.75	21.25	21.50	.....	20.50	19.50	19.85	20.00	19.00	.....	.....	.....	16.50	.....
Punchings and plate scrap[4]	22.75	21.00	19.75	19.75	19.25	19.75	19.75	20.25	20.50	.....	19.50	18.50	18.85	19.00	18.00	.....	.....	.....	15.50	.....
Heavy axle, forge turnings	21.25	19.50	18.25	18.25	17.75	18.25	18.25	18.75	19.00	.....	18.00	17.00	17.35	17.50	16.50	.....	.....	.....	14.00	.....
Medium h'vy el f'ce turnings	19.75	18.00	16.75	16.75	16.25	16.75	16.75	17.25	17.50	.....	16.50	15.50	15.85	16.00	15.00	.....	.....	.....	12.50	.....

[1] This grade is ⅜-in. and heavier, cut 12 in. and under. [2] May include clean agricultural cast. [3] Under ⅜ to ¼-in., cut 12 in. and under. [4] Under ¼-in. to No. 12 gage, cut 12 in. and under. [5] Youngstown, Warren, Sharon and Canton are not basing points on this grade. [6] Middletown and Cincinnati price for this grade is $15. * Includes Newport, Ky. Shipping point price within Cincinnati basing point may be 80c. a ton below basing point price listed above for all grades except the six cast grades. ** Minneapolis and St. Paul are basing points on following grades only: No. 1 cupola, heavy breakable cast, stove plate, machinery cast cupola size, No. 1 machinery cast drop broken, clean auto cast.

Railroad Scrap *(Per gross ton, delivered consumers' plants located on line of railroad originating scrap)*

Basing Points → / ▼ GRADES	Pittsburgh Sharon, Pa. Wheeling Steubenville Youngstown Canton	Chicago	Kokomo	Philadelphia	Wilmington	Sparrows Point	Cleveland	Buffalo	Portsmouth Middletown Ashland	St. Louis	Kansas City	Cincinnati	Detroit	Duluth	Birmingham	Los Angeles San Francisco Seattle
No. 1 heavy melting	$21.00	$19.75	$19.25	$19.75	$19.75	$19.75	$20.50	$20.25	$20.50	$18.50	$17.00	$20.50	$18.85	$19.00	$18.00	$15.50
Scrap rails	22.00	20.75	20.25	20.75	20.75	20.75	21.50	21.25	21.50	19.50	18.00	21.50	19.85	20.00	19.00	16.50
Rerolling rails	23.50	22.25	21.75	22.25	22.25	22.25	23.00	22.75	23.00	21.00	19.50	23.00	21.35	21.50	20.50	18.00
Scrap rails 3 ft. and under	24.00	22.75	22.25	22.75	22.75	22.75	23.50	23.25	23.50	21.50	20.00	23.50	21.85	22.00	21.00	18.50
Scrap rails 2 ft. and under	24.25	23.00	22.50	23.00	23.00	23.00	23.75	23.50	23.75	21.75	20.25	27.75	22.10	22.25	21.25	18.75
Scrap rails 18 in. and under	24.50	23.25	22.75	23.25	23.25	23.25	24.00	23.75	24.00	22.00	20.50	24.00	22.35	22.50	21.50	19.00

Railroads not operating in a basing point may sell rerolling rails f.o.b. their lines at average price of their sales from Sept. 1, 1940, to Jan. 31, 1941. Rerolling mills may absorb all transportation charges necessary to obtain such rails. Maximum prices for scrap rails and rerolling rails from mines, logging camps and similar sources need not be sold for less than $13.50 a gross ton for scrap rails and $15 for rerolling material at shipping point.

Where the railroad originator of the scrap operates in two or more of the basing points named, the highest of the maximum prices established for such basing points shall be the maximum price of the scrap delivered to a consumer's plant at any point on the railroad's line, except that switching charges of 84c. per gross ton shall be subtracted from the maximum prices of scrap originating from railroads operating in Chicago and sold for consumption outside Chicago.

Explanatory Notes

(A basing point includes its switching district)

MAXIMUM PRICE at which any grade of scrap may be delivered to consumer's plant, wherever located, is the shipping point price, plus actual transportation from the shipping point to consumer. Where shipment is by water, actual handling charges at the dock of not more than 75c. a gross ton may be included as part of transportation charges. In no case may this maximum price exceed by more than $1 prices (for material other than railroad scrap) for the basing point nearest the consumer.

COMPUTING SHIPPING POINT PRICE: A shipping point is the point from which the scrap is to be shipped to a consumer. A shipping point price is computed as follows: (a) For Shipping Points located within a basing point.—The price established for the basing point in which the shipping point is located, is determined. Then deduct from this the actual costs involved in transporting scrap from the shipping point to the consumer's plant within the basing point which is nearest, in terms of transportation costs, to the shipping point; (b) For shipping points located outside a basing point.—The price established for the nearest basing point, in terms of transportation charges, to the shipping point is determined. Deduct from this the lowest established charge for transporting scrap from the shipping point to such basing point. *Exceptions:* (1) The shipping point price at any shipping point in New England, of those grades of scrap for which no prices are listed above shall be the Johnstown basing point price, minus the all-rail transportation costs from the New England shipping point to Johnstown; (2) Shipping point prices for New York City, Brooklyn, New York, and New Jersey shall be computed from the Bethtlehem, Pa., basing point.

GULF PORT PRICES: Scrap shipped from Tampa, Pensacola, Gulfport, Mobile, New Orleans, Lake Charles, Port Arthur, Beaumont, Galveston, Texas City, Houston and Corpus Christi, has a maximum shipping point price not exceeding $14 a gross ton, f.o.b. cars, for No. 1 heavy melting steel. For other grades, the differentials established for Birmingham apply.

REMOTE SCRAP: Defined as all grades of scrap listed in table above (exclusive of railroad scrap) located in Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas and Oklahoma. Maximum shipping point price of remote scrap is $12 a gross ton, for No. 2 heavy melting steel, with differentials for other grades the same as differentials established in table above for St. Louis. The maximum delivered price of remote scrap is the shipping point price, plus actual transportation charges, except that when necessary to absorb transportation charges, the maximum delivered price may be exceeded by a maximum of $4 a ton. Thus the maximum delivered price for remote scrap may exceed the price for the nearest basing point by $5. In the event that an allowance in excess of $5 a ton is necessary to acquire a tonnage of remote scrap, a consumer may apply to OPA for permission to exceed the $5 allowance. Purchases under these remote scrap provisions must be for not less than one car a month and must be reported in detail. Provisions of this remote scrap section expire Dec. 31, 1941.

BROKER COMMISSIONS: A commission of up to 50c. a ton above the maximum prices is allowed to brokers.

*OPA maximum for sale by dealer. **Nominal.

UNPREPARED SCRAP: Regardless of source, maximum price of unprepared scrap is $2.50 less than maximum for corresponding grade of prepared scrap.

BILLET AND BLOOM CROPS: Where such material originates in the Pittsburgh basing point, it may be sold delivered to a consumer within or without the Pittsburgh point at the price given in Schedule A, plus not more than $2.50 in transportation charges. Lowest established transportation charges will govern.

Non-Ferrous Scrap

(Dealers buying prices, cents per lb.)

	New York	Philadelphia	Pittsburgh	Cleveland	Detroit	Chicago
No. 1 hvy. copper	*10.00	*10.00	*10.00	*10.00	*10.00	*10.00
Light copper	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00	* 8.00
Hvy. yel. brass	6.25-6.50	**6.25	7.50-8.00	5.75-6.25	7.00-7.25	7.50
Light brass	5.25-5.50	**5.50	7.00-7.25	6.00-6.50	6.50-6.75	7.00-7.25
No. 1 Comp. turn.	8.75-9.00	**7.75	**9.00-9.25	8.50-9.00	9.00-9.25	9.00-9.25
New brass clips	8.00-8.25	8.50-9.00	7.75-8.00	8.00-8.50	7.50-8.00	7.75-8.25
Soft lead	5.25-5.50	5.00-5.25	4.75-5.00	4.75-5.00	5.00-5.25	4.75-5.00
Old zinc	4.00-4.25	4.25	4.25-4.50	4.00-4.50	4.25-4.50	4.50-5.00
Cast, forged alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Old sheet alum.	*11.00	*11.00	*11.00	*11.00	*11.00	*11.00
Solder joints	8.75-9.00	9.00	7.50-8.00	6.50-6.75	5.50-6.00	7.50-8.00
No. 1 pewter	35.00-36.00	35.00-36.00	31.00-32.00	32.50-34.00	37.50-38.50	32.80-34.00

* OPA maximum for sale by dealer. ** Nominal.

. . . Comparison of Prices

(Advances Over Past Week in **Heavy Type**; Declines in *Italics*)

(Prices Are F.O.B. Major Basing Points)

	Oct. 28, 1941	Oct. 21, 1941	Sept. 30, 1941	Oct. 29, 1940
Flat Rolled Steel: (Cents Per Lb.)				
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless Bars (No. 302)	24.00	24.00	24.00	24.00
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

	Oct. 28, 1941	Oct. 21, 1941	Sept. 30, 1941	Oct. 29, 1940
Pig Iron: (Per Gross Ton)				
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$24.84
No. 2, Valley furnace	24.00	24.00	24.00	23.00
No. 2, Southern Cin'ti	24.06	24.06	24.06	23.06
No. 2, Birmingham	20.38	20.38	20.38	19.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	23.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	24.34
Basic, Valley furnace	23.50	23.50	23.50	22.50
Malleable, Chicago†	24.00	24.00	24.00	23.00
Malleable, Valley	24.00	24.00	24.00	23.00
L. S. charcoal, Chicago	31.34	31.34	31.34	30.34
Ferromanganese‡	120.00	120.00	120.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton. ‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melt'g Steel, P'gh.	$20.00	$20.00	$20.00	$21.50
Heavy melt'g steel, Phila.	18.75	18.75	18.75	20.75
Heavy melt'g steel, Ch'go	18.75	18.75	18.75	19.75
No. 1 hy. comp sheet, Det.	17.85	17.85	17.85	18.50
Low, phos. plate, Youngs'n	23.00	23.00	23.00	24.00
No. 1 cast, Pittsburgh	22.00	22.00	22.00	22.25
No. 1 cast, Philadelphia	24.00	24.00	24.00	22.75
No. 1 cast, Ch'go*	21.00	21.00	21.00	17.75

*Changed to gross ton basis, April 3, 1941.

Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.125	$6.125	$6.125	$4.75
Foundry coke, prompt	6.875	6.875	6.875	5.25
Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.*	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	51.50
Zinc, East St. Louis	8.25	8.25	7.25	7.25
Lead, St. Louis	5.70	5.70	5.70	5.35
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in detailed price tables, pages 112-118.
On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

. . . Composite Prices

	FINISHED STEEL	PIG IRON	SCRAP STEEL
Oct. 28, 1941	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.30467c. a Lb.	$22.61 a Gross Ton	$20.67 a Gross Ton

	High	Low	High	Low	High	Low
1941	2.30467c.,	2.30467c.,	$23.61, Mar. 20	$23.45, Jan. 2	$22.00, Jan. 7	$19.17, Apr. 10
1940	2.30467c., Jan. 2	2.24107c., Apr. 16	23.45, Dec. 23	22.61, Jan. 2	21.83, Dec. 30	16.04, Apr. 9
1939	2.35367c., Jan. 3	2.26689c., May 16	22.61, Sept. 19	20.61, Sept. 12	22.50, Oct. 3	14.08, May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18	23.25, June 21	19.61, July 6	15.00, Nov. 22	11.00, June 7
1937	2.58414c., Mar. 9	2.32263c., Jan. 4	23.25, Mar. 9	20.25, Feb. 16	21.92, Mar. 30	12.92, Nov. 10
1936	2.32263c., Dec. 28	2.05200c., Mar. 10	19.74, Nov. 24	18.73, Aug. 11	17.75, Dec. 21	12.67, June 9
1935	2.07642c., Oct. 1	2.06492c., Jan. 8	18.84, Nov. 5	17.83, May 14	13.42, Dec. 10	10.33, Apr. 29
1934	2.15367c., Apr. 24	1.95757c., Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	1.95578c., Oct. 3	1.75836c., May 2	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.89196c., July 5	1.83901c., Mar. 1	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	1.99629c., Jan. 13	1.86586c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3

A weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip. These products represent 78 per cent of the United States output. This revised index recapitulated to 1929 in the Aug. 28, 1941, issue.

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Prices of Finished Iron and Steel...

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢		2.65¢	2.20¢	2.34¢	2.27¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢		3.70¢	3.15¢	3.39¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢		4.05¢		3.74¢	3.67¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢		4.00¢	3.45¢	3.71¢	3.67¢
Long ternes[2]	3.80¢		3.80¢									4.55¢			
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢		2.75¢	2.20¢	2.46¢	
Cold rolled[4]	2.80¢	2.90¢		2.80¢			2.80¢	(Worcester = 3.00¢)					2.90¢	3.16¢	
Cooperage stock	2.20¢	2.20¢			2.20¢		2.20¢							2.56¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester = 3.35¢)					3.05¢	3.31¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10						$5.32
BLACK PLATE															
29 gage[5]	3.05¢	3.05¢	3.05¢						3.15¢			4.05¢ (10)			3.37¢
TERNES M'FG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth = 2.25¢)			2.50¢	2.80¢	2.25¢	2.49¢	2.47¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.50¢	2.80¢			
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢			2.50¢	2.55¢	2.25¢	2.39¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢				2.50¢	2.55¢	2.25¢		2.47¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit = 2.70¢)					3.01¢	2.97¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massillon, Canton = 2.70¢					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont = 2.10¢)							
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.25¢(11)		2.45¢	2.65¢	2.25¢	2.29¢	2.15¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢									3.70¢	4.00¢		3.71¢	3.67¢
Alloy	3.50¢	3.50¢			(Coatesville = 3.50¢)						3.95¢	4.15¢		3.70¢	3.37¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem = 2.10¢)			2.45¢	2.75¢		2.27¢	2.215¢
SPRING STEEL C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester = 3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester = 4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester = 6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester = 8.55¢)								
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester = 2.70¢)					3.10¢			2.92¢
Spring	3.20¢	3.20¢		3.20¢			(Worcester = 3.30¢)					3.80¢			3.52¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢						2.95¢			2.72¢
IRON BARS															
Common		2.25¢			(Terre Haute, Ind. = 2.15¢)										
Wrought single refined	4.40¢														
Wrought double refined	5.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Straight lengths as quoted by distributers. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lot to manufacturing trade. [10] Boxed. [11] Ship plates only.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2 higher; f.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Shell Steel

Basic open hearth shell steel, f.o.b. Pittsburgh and Chicago.

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)	*Per Lb.*
Pittsburgh, Chicago, Cleveland	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Alloy Steel Blooms, Billets and Slabs

	Per Gross Ton
Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem	$54.00

TOOL STEEL

(F.o.b. Pittsburgh)

	Base per Lb.
High speed	67c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Prices for warehouse distribution to all points on or East of Mississippi River are 2c. a lb. higher. West of Mississippi quotations are 3c. a lb. higher.

PIG IRON

All prices set in bold face type are maxima established by OPACS on June 24, 1941. Other domestic prices are delivered quotations per gross ton computed on the basis of the official maxima.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorous	Charcoal
Boston	$25.50	$25.00	$26.50	$26.00	.....	.....
Brooklyn	27.50	.....	.....	28.00	.....	.....
Jersey City	26.53	26.03	27.53	27.03	.....	.....
Philadelphia	25.84	25.34	26.84	26.34	.....	.....
Bethlehem, Pa.	**$25.00**	**$24.50**	**$26.00**	**$25.50**	.....	.....
Everett, Mass.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Swedeland, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Steelton, Pa.	.....	**24.50**	.....	.....	**$29.50**	.....
Birdsboro, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	**29.50**	.....
Sparrows Point, Md.	**25.00**	**24.50**	.....	.....	.....	.....
Erie, Pa.	**24.00**	**23.50**	**25.00**	**24.50**	.....	.....
Neville Island, Pa.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Sharpsville, Pa.*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Buffalo	**24.00**	**23.00**	**25.00**	**24.50**	**29.50**	.....
Cincinnati	24.44	24.61	.....	25.11	.....	.....
Canton, Ohio	25.39	24.89	25.89	25.39	.....	.....
Mansfield, Ohio	25.94	25.44	26.44	25.94	.....	.....
St. Louis	24.50	24.02	.....	.....	.....	.....
Chicago	**24.00**	**23.50**	**24.50**	**24.00**	.....	..... $31.34
Granite City, Ill.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Cleveland	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Hamilton, Ohio	**24.00**	**23.50**	.....	**24.00**	.....	.....
Toledo	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Youngstown*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Detroit	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	**$28.00**
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	**33.00**
St. Paul	26.63	.....	27.13	26.63	.....	.....
Duluth	**24.50**	.....	**25.00**	**24.50**	.....	.....
Birmingham	**20.38**	**19.00**	**25.00**	.....	.....	.....
Los Angeles	27.50	.....	.....	.....	.....	.....
San Francisco	27.50	.....	.....	.....	.....	.....
Seattle	27.50	.....	.....	.....	.....	.....
Provo, Utah	**22.00**	.....	.....	.....	.....	.....
Montreal	27.50	27.50	.....	28.00	.....	.....
Toronto	25.50	25.50	.....	26.00	.....	.....

GRAY FORGE IRON

Valley or Pittsburgh furnace **$23.50**

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade (1.75 per cent to 2.25 per cent).

Phosphorous Differential: Basing point prices are subject to a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over.

† Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

Manganese Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.50 per cent manganese content in excess of 1.00 per cent.

WAREHOUSE PRICES

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.35	$3 25	$3.35	$3.75	$3.58	$3.43	$3.25	$3.71	$3.45	$3.39	$3.30	$3.38	$5.10
Sheets, cold rolled	....	4.10	4.05	4.05	4.60	4.30	4.30	3.68	....	4.24	4.35	4.23	7.30
Sheets, galvanized	4.65	4.85	4.75	5.00	5.00	4.84	4.75	5.11	4.75	4.99	4.75	4.98	6.30
Strip, hot rolled	3.60	3.60	3.50	3.95	3.96	3.68*	3.82	4.06	3.70	3.74	3.65	3.73	....
Strip, cold rolled	3.20	3.50	3.20	3.31	3.51	3.40	3.52	3.46	....	3.61	3.83	3.54	....
Plates	3.40	3.55	3.40	3.75	3.76	3.60	3.62	3.85	3.55	3.69	3.80	3.68	4.95
Structural shapes	3.40	3.55	3.58	3.75	3.75	3.65	3.40	3.85	3.55	3.69	3.80	3.68	4.95
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.64	3.75	3.63	**4.15
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.45	7.35	7.55	7.31	7.60	7.67	7.35	7.50	....	7.72	7.45	7.58	10.35
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	9.35
Bars, cd. drn. SAE 2300	8.40	8.40	8.40	8.56	8.84	8.70	8.40	8.63	....	8.77	8.84	8.63	11.35
Bars, cd. drn. SAE 3100	6.75	6.75	7.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	10.35

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb., galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions; Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb., cold rolled strips, 0.0971 in. thick; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., cold rolled strip 0.095 in. and lighter; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb.; New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, cold rolled sheets, 300 to 1999 lb., galvanized sheets, 24 ga.—1 to 1499 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, $3.43. **Over 4 in. wide and over 1 in. thick, $4.95.

CORROSION AND HEAT-RESISTING STEELS

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F. Billets	15.73c.	16.15c.	19.13c.	23.38c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hotstrip	17.00c.	17.50c.	24.00c.	25.00c.
Cold st.	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
*Motor	4.95c.
*Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 75c. per 100 lb.

*In some instances motor grade is referred to as dynamo grade and dynamo grade is referred to as dynamo special.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, per Package of 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and Carriage Bolts:

6 ½ in., shorter and smaller	65½
6 x ⅝ in., and shorter	63½
6 in. by ¾ to 1 in. and shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

(hexagon or square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose	71 and 10
Stove bolts in packages, with nuts attached	71
Stove bolts in bulk	80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 Lb.

F.o.b Pittsburgh, Cleveland, Chicago, Birmingham $3.75

Small Rivets

(7/16 in. and smaller)

Per Cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham ..... 65 and 5

Cap and Set Screws

Per Cent Off List

Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller	60
Upset set screws, cup and oval points	68
Milled studs	40
Flat head cap screws, listed sizes	30
Filister head cap, listed sizes	46

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

WIRE PRODUCTS

(To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails	$2.55
Coated nails	2.55
Cut nails, carloads	3.85

Base per 100 Lb.

Annealed fence wire	$3.05

Base Column

Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes. Minimum Wall

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Hot Rolled	Lap Weld, Hot Rolled
	$	$	$
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)

Base Price = $200 Per Net Ton

Steel (Butt Weld)

	Black	Galv
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher, on all butt weld 8 in. and smaller.

CAST IRON WATER PIPE

Per Net Ton

6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

FUEL OIL

No. 3, f.o.b. Bayonne, N. J.	5.20c.
No. 6, f.o.b. Bayonne, N. J.	3.21c.
No. 6 Bur. Stds., del'd Chicago	4.50c.
No. 3 distillate del'd Cleveland	6.50c.
No. 4 indus., del'd Cleveland	6.00c.
No. 6 indus., del'd Cleveland	5.00c.

REMOVING 18 LBS. of nitrided steel IN 7 MINUTES

What's the P-Q* of your cutting tools?

Finning air-cooled airplane engine cylinders at the rate of 7 cylinders per hour . . . removing 18 lbs. of nitrided steel in 7 minutes—that's the performance record with SUNICUT. . . . A record that helps maintain the high P-Q* (Production Quota) set by this large airplane engine manufacturer with an "all-out" production schedule.

In the airplane industry, and in metal working industries of all kinds, SUNICUT is helping manufacturers maintain a higher P-Q* for their cutting tools. The excellent heat absorbing and wetting out properties of this modern transparent, sulphurized cutting oil make possible increased speeds and feeds and improved finishes with precision.

On performance alone, SUNICUT has won recognition. A test —in your own shop—may prove to be your first step toward making possible a higher P-Q.*

Write to SUN OIL COMPANY, PHILADELPHIA, PA.

SUNICUT

NON-EMULSIFYING . . . TRANSPARENT

CUTTING OIL

PERFORMANCE DATA

OPERATION—Finning Air Cooled Airplane Engine Cylinder.

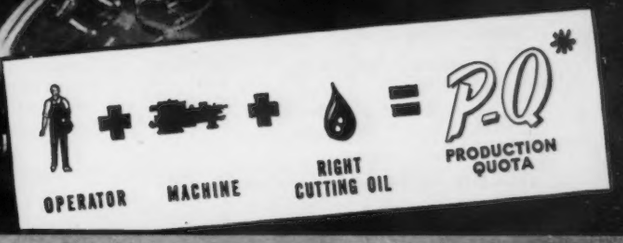
MACHINE—Jones & Lamson Heavy Duty 16" Fay Automatic Lathe.

MATERIAL—Nitrided Steel.

TOOLS—47 H.S.S. tools in a single bank, removing 18 lbs. of metal in 7 minutes cutting time.

CUTTING LUBRICANT—Sunicut

Photo Courtesy of
JONES & LAMSON MACHINE CO.



SUN OILS

PETROLEUM PRODUCTS FOR ALL INDUSTRIES

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans, Domestic, 80%, per gross ton (carloads)...$120.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$36.00
Domestic, 26 to 28%..... 49.50

Electric Ferrosilicon

(Per Gross Ton, Delivered Lump Size)

50% (carload lots, bulk).....$74.50
50% (ton lots, packed)..... 87.00
75% (carload lots, bulk).....135.00
75% (ton lots, packed).....151.00

Silvery Iron

(Per Gross Tons, base 6.00 to 6.50 Si)

F.O.B. Jackson, Ohio $29.50*
Buffalo $30.75*

For each additional 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorous or over.

* Official OPACS price established June 24.

Bessemer Ferrosilicon

Prices are $1 a ton above Silvery Iron quotations of comparable analysis.

Ferrochrome

(Per Lb. Contained Cr, Delivered Carlots, Lump Size, on Contract)

4 to 6 carbon .....13.00c.
2 carbon .....19.50c.
1 carbon .....20.50c.
0.10 carbon .....22.50c.
0.06 carbon .....23.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

(Per Gross Ton, Delivered, Lump Size, Bulk, on Contract)

3 carbon $113.00*
2.50 carbon 118.00*
2 carbon 123.00*
1 carbon 133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del'd carload..... $2.00
Ferrotungsten, 100 lb. and less $2.25
Ferrovanadium, contract, per lb. contained V, del'd $2.70 to $2.90†
Ferrocolumbium, per lb. contained Cb, f.o.b. Niagara Falls, N. Y., ton lots..... $2.25†
Ferrocarbontitanium, 15-18 Ti, 7-8 C, f.o.b. furnace, carload, contract, net ton.....$142.50
Ferrocarbontitanium, 17-20 Ti, 3-5 C, f.o.b. furnace, carload, contract, net ton.....$157.50
Ferrophosphorus, electric or blast furnace material, carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage freight, equalized with Rockdale, Tenn., gross ton..... $58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsato (Siglo), Tenn., $3 unitage, freight equalized with Nashville, gross ton..... $75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace ..... 95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace..... 80c.
Molybdenum oxide briquettes 48-52 Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.... 80c.
Molybdenum oxide, in cans, per lb. contained Mo, f.o.b. Langeloth, and Washington, Pa. 80c.

*Spot prices are $5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores (51.50% Fe.)

(Delivered Lower Lake Ports)

Per Gross Ton

Old range, bessemer, 51.50.... $4.75
Old range, non-bessemer, 51.50 4.60
Mesaba, bessemer, 51.50..... 4.60
Mesaba, non-bessemer, 51.50... 4.45
High phosphorus, 51.50..... 4.35

Foreign Ores*

(C.i.f. Philadelphia or Baltimore, Exclusive of Duty)

Per Unit

African, Indian, 44-48 Mn..65c. to 66c.
African, Indian, 49-51 Mn..67c. to 69c.
Brazilian, 46-48 Mn .....69c.
Cuban, del'd, 51 Mn .....78c.

Per Short Ton Unit

Tungsten, Chinese Wolframite, duty paid, delivered.....$24 to $26
Tungsten, domestic scheelite, at mine .....$24.00 to $25.00
Chrome ore, lump, c.i.f. Atlantic Seaboard, per gross ton; South African (low grade).....Nom.
Rhodesian, 45 .....$32.00
Rhodesian, 48 .....$39.00-$40.00

*Importations no longer readily available. Prices shown are nominal.

COKE*

Furnace *Per Net Ton*

Connellsville, prompt ...$6.00 to $6.25

Foundry

Connellsville, prompt ...$6.75 to $7.00

* Maximum coke prices established by OPA became effective Oct. 1, 1941. A complete schedule of the ceiling prices was published in THE IRON AGE, Sept. 25, p. 94B. † F.O.B. oven.

By-product, Chicago $12.25
By-product, New England.....$13.75
By-product, Newark..$12.40 to $12.95
By-product, Philadelphia $12.38
By-product, Cleveland $12.30
By-product, Cincinnati $11.75
By-product, Birmingham .....$8.50†
By-product, St. Louis $12.02
By-product, Buffalo $12.50

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Standard rails, heavier than 60 lb., gross ton $40.00
Angle bars, 100 lb. 2.70

(F.o.b. Basing Points) *Per Gross Ton*

Light rails (from billets).....$40.00
Light rails (from rail steel)... 39.00

Base per Lb.

Cut spikes ..... 3.00c.
Screw spikes ..... 5.15c.
Tie plates, steel ..... 2.15c.
Tie plates, Pacific Coast ..... 2.30c.
Track bolts, heat treated, to railroads ..... 5.00c.
Track bolts, jobbers discount.. 63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va.

FLUORSPAR

Per Net Ton

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail.....$22.00 to $23.00
Domestic, f.o.b. Ohio River landing barges ..... 22.00 to 23.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines..22.00 to 23.00
Foreign, 85% calcium fluoride, not over 5% Si, c.i.f. Atlantic ports, duty paid.....Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines.... 31.00
As above, in bags, f.o.b. same mines 32.60

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick *Per 1000*

Super-duty brick, St. Louis...$64.60
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 51.30
First quality, New Jersey..... 56.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri, and Illinois 46.55
Second quality, New Jersey.... 51.00
No. 1, Ohio 43.00
Ground fire clay, net ton..... 7.60

Silica Brick

Pennsylvania $51.30
Chicago District 58.90
Birmingham 51.30
Silica cement, net ton (Eastern) 9.00

Chrome Brick *Per Net Ton*

Standard, f.o.b. Baltimore, Plymouth Meeting and Chester...$54.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa. 54.00

Magnesite Brick

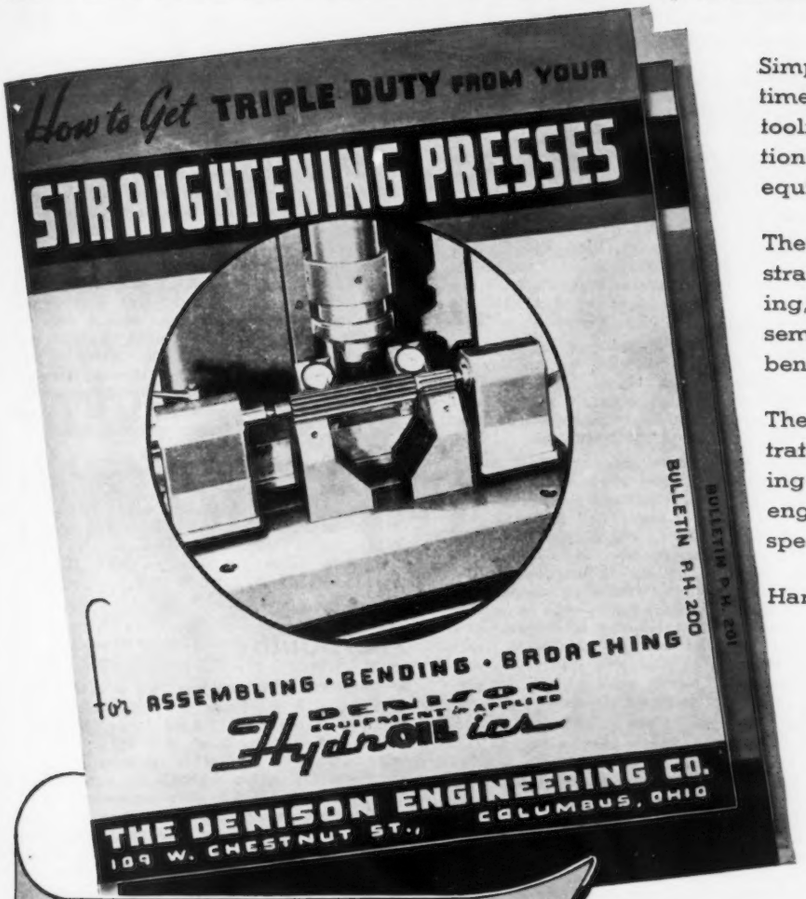
Standard f.o.b. Baltimore and Chester $76.00
Chemically bonded, f.o.b. Baltimore 65.00

Grain Magnesite

Domestic, f.o.b. Baltimore and Chester in sacks $44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk) 22.00

While You Wait for Equipment

GET EXTRA PRODUCTION BY RETOOLING YOUR PRESENT PRESSES *for* ASSEMBLING BENDING, BROACHING, STRAIGHTENING



Simple and easy to understand, these timely bulletins are guides to emergency tooling. They'll help you meet production demands while you wait for new equipment.

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There are plenty of drawings and illustrations showing common types of tooling and their applications. Your own engineers can develop them further for special, out-of-the-ordinary jobs.

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SALES POSSIBILITIES

. . . CONSTRUCTION, PLANT EXPANSION AND EQUIPMENT BUYING

North Atlantic States

• **Rothwell-Smith Brass Foundry,** 360 Roosevelt Avenue, Pawtucket, R. I., plans new one-story foundry at Mill Street and Mendon Road, Cumberland, R. I., 80 x 100 ft. Cost close to $45,000 with equipment. Present plant will be continued.

Whitney Chain & Mfg. Co., 169 Batholomew Avenue, Hartford, Conn., has let general contract to Bartlett-Brainard Co., 103 Woodbine Street, for two-story addition, with foundations for two additional floors later. Cost over $65,000 with equipment. Golin T. Henderson, 750 Main Street, is architect.

New Britain Machine Co., New Britain, Conn., automatic screw machines and screw machine products, has let general contract to Hasson & Downes, Inc., New Britain, for one-story addition, 100 x 140 ft. Cost over $75,000 with equipment.

Niles-Bement-Pond Co., West Hartford, Conn., plans installation of additional equipment at local plant for production of tools for government. Cost about $405,000, appropriation to be secured through Defense Plant Corp., Washington.

Bowen-Hunter Bobbin Co., East Corinth, Vt., textile mill equipment, plans rebuilding part of main one-story mill recently damaged by fire. Loss about $60,000 with equipment.

Board of Education, 129 Church Street, New Haven, Conn., will remodel one-story building near Whalley Avenue for machine shop for a defense training school. Leo F. Caproni, 1221 Chapel Street, is architect and engineer.

Rolock, Inc., Southport, Conn., wire cloth and kindred wire goods, has let general contract to Burr Perry, 857 Bronson Drive, Fairfield, Conn., for new one-story plant, 100 x 100 ft., at Fairfield, with two-story office adjoining. Cost over $75,000 with equipment. Lyons & Mather, 211 State Street, Bridgeport, Conn., are architects.

Greater New York Brewery, Inc., 501 Fifth Avenue, New York, has approved plans for new three-story and basement storage and distributing plant at 912 Cypress Avenue, Brooklyn. Cost about $125,000 with equipment. Joseph D. Weiss, 119 West Fifty-seventh Street, New York, is architect.

United States Engineer Office, New York District, 17 Battery Place, New York, asks bids until Nov. 5 for manganese bronze propellers (Circular 1097-42-107).

Continental Can Co., Inc., 100 East Forty-second Street, New York, plans addition to branch plant at San Jose, Cal., including two or more one-story units for production division, storage and distribution. Cost about $200,000 with equipment. San Francisco offices are at 155 Montgomery Street.

Solvay Process Co., 40 Rector Street, New York, chemicals, etc., plans expansion in soda ash plant at Baton Rouge, La., comprising several one and multi-story units; also will make additions to limestone quarry at Winfield, La. Brine properties in Choctaw Dome field, Iberville Parish, La., will be expanded, including two new booster stations for increased pipe line service to plant at Baton Rouge. Work is scheduled to begin early in December. Cost close to $5,000,000 with equipment.

Cameron Machine Co., 61 Poplar Street, Brooklyn, slitting and roll-winding machines, and other machinery for paper, rubber and other industries, plans one-story addition, about 76 x 95 ft., for expansion in machine shop and assembling department. Cost over $75,000 with equipment. Harry M. Sushan, 367 Fulton Street, is architect.

Farnham Mfg. Co., 1646 Seneca Street, Buffalo, machinery and parts, has let general contract to H. F. Stimm, Inc., Ellicott Square, for one-story addition, about 30 x 100 ft., for storage and distribution. Cost close to $40,000 with equipment.

Eastman Kodak Co., Kodak Park, Rochester, N. Y., has let general contract to A. W. Hopeman & Sons Co., 569 Lyell Avenue, for four-story addition, 60 x 215 ft., for production of precision optical apparatus. Cost over $400,000 with equipment.

Symington-Gould Corp., 20 Symington Place, Rochester, N. Y., iron castings, railroad equipment, etc., will equip one-story addition, recently noted, for production of tank armor plate for government, and will expend close to $750,000 for machinery, with erection estimated at $505,100. Work is scheduled to begin in November. Defense Plant Corp., Washington, will furnish fund of $1,255,100 for project.

E. I. du Pont de Nemours & Co., Inc., R. & H. Chemical Division, 71 Buckingham Place, Perth Amboy, N. J., plans two-story and basement addition, about 40 x 80 ft., and improvements in an existing building. Cost close to $45,000 with equipment.

Eureka Iron Works, Inc., 102 Main Street, Newark, N. J., iron and steel products, welded equipment, etc., has purchased plant of Cooper Alloy Foundry Co., 142-54 Broadway, Elizabeth, N. J., consisting of one and two-story buildings on site 100 x 175 ft., totaling about 25,000 sq. ft. of floor space. Present plant will be transferred to new location, where increased capacity will be carried out. Cooper Alloy company is erecting new foundry and other buildings on 15-acre tract at Hillside, N. J., and will remove to that location, where larger capacity will be provided for special castings, stainless steel products, etc.

United Crane & Shovel Service Co., 30 Ogden Street, Newark, N. J., has begun erection of new one-story plant, 65 x 100 ft., at Kenilworth, N. J., for general production, reconditioning, repairs, etc., and will remove to new location and increase capacity.

Purolator Products, Inc., 365 Frelinghuysen Avenue, Newark, N. J., oil filters, parts, etc., has purchased four-story building at 334-60 Elizabeth Avenue, about 45,000 sq. ft. of floor space, on three-acre tract, and will improve for production, supplementing present works at first noted location.

Kellett Autogiro Corp., 5701 Grays Ferry Avenue, Philadelphia, aircraft, plans installation of additional equipment for production of airplane parts for government. Cost about $95,950, fund in that amount to be secured through Defense Plant Corp., Washington.

Willson Products, Inc., Washington Street, Reading, Pa., goggles, eye shields, etc., for industrial service, plans new one-story plant on North Third Street, about 35 x 120 ft. Cost over $50,000 with equipment.

Aviation Mfg. Corp., Lycoming Division, Williamsport, Pa., aircraft engines and parts, plans new local works for production of engine units for government. Cost about $3,714,300 for site, buildings and machinery, fund in that amount to be furnished by Defense Plant Corp., Washington.

Lock Haven School District, Lock Haven, Pa., J. F. Puderbaugh, superintendent, plans new one-story vocational school on tract about 250 x 300 ft., recently selected. Cost close to $175,000 with equipment.

Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, plans one-story blooming mill at branch plant at Massena, N. Y., totaling 450,000 sq. ft. of floor space for production of forgings, rods, fittings, etc., for government. Cost about $15,000,000.

Standard Stoker Co., 1701 Gaskell Avenue, Erie, Pa., stokers, parts, etc., has let general contract to Upton-Lang Co., Commerce Building, for one-story addition for storage and distribution. Cost about $45,000 with equipment.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for 13 30-ton nominal rating diesel engine locomotive cranes for Navy yards at Boston and Brooklyn (Specification 10670).

Maryland Dry Dock Co., Fairfield, Baltimore, plans nine one and multi-story buildings for expansion in mechanical shops and general service structures; also one-story additions to present shops and improvements in existing buildings, including main machine works; new shipways and dry docks will be built, with auxiliary structures. A floating machine shop will be installed. Present ship repair plant will be increased about 50 per cent for handling vessels for government. Entire project will cost about $5,000,000. Fund of $3,894,000 was secured recently through Defense Plant Corp., Washington, and additional appropriation will be arranged. J. E. Greiner Co., 1201 St. Paul Street, is consulting engineer.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Nov. 4 for portable pneumatic tools (Schedule 9126), countersinks and reamers (Schedule 9134); until Nov. 6 for braces and drills (Schedule 9114) for Eastern and Western Navy yards.

The South

• **Charleston Shipbuilding & Drydock Co.,** Charleston, S. C., plans new 6000-ton floating drydock at plant on Copper River, with two piers, each 480 ft. long, and 40 and 50 ft. wide, with shops and other facilities, for construction of seagoing tugboats for government. Cost about $2,000,000 with equipment. This is in addition to expansion and improvements now in progress at yard, including rebuilding and modernization of wharves, docks, ways, shops and other structures, to cost approximately $1,000,000 with equipment.

City Council, Roanoke, Va., plans new steel hangar with shop and repair facilities in connection with expansion and improvements at municipal airport; also will remodel an existing hangar for repair shop, with administration building. Cost about $120,000.

United States Engineer Office, Vicksburg, Miss., asks bids until Nov. 3 for bronze castings (Circular 64).

East Kentucky Rural Electric Co-operative Corp., Guy Cridwell, Cynthiana, Ky., secretary, plans new steam-electric generating station near Danville, Ky., for power supply for rural electric systems in about 55 counties, with transmission lines, power substations and auxiliary structures. Cost about $2,000,000. Fund in that amount is being secured through Federal aid.

General Metals Corp., Liberty Road, Houston, Tex., forgings, etc., plans one-story addition for expansion in forge and die shops, and inspection division, installation to include a 4000-lb. steam hammer, die-making equipment, trimming and cleaning machinery, etc. Cost close to $150,000 with equipment. Main offices are at 701 105th Avenue, Oakland, Cal.

Westinghouse Electric & Mfg. Co., East Pittsburgh, plans addition to factory branch, storage and distributing plant at 426 Marietta Street, N. W., Atlanta, Ga. Cost over $80,000 with equipment.

Swift & Co., 400 South Mint Street, Charlotte, N. C., meat packer, has let general con-

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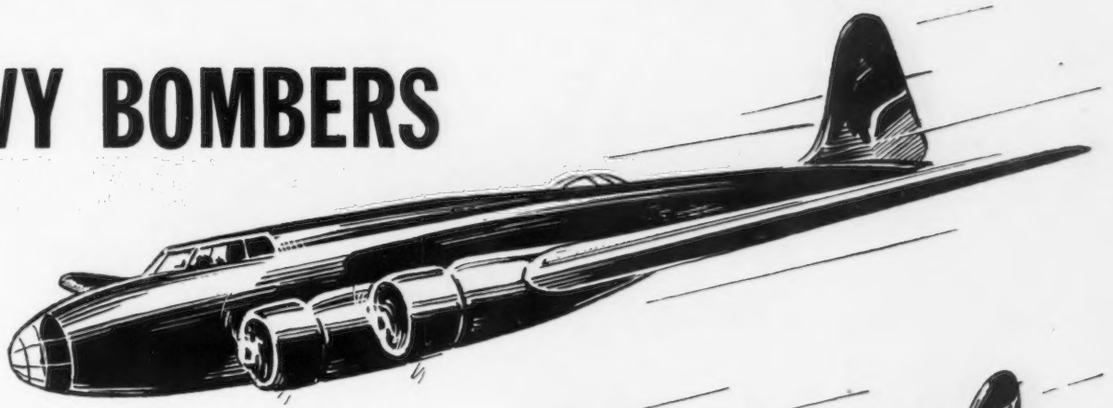

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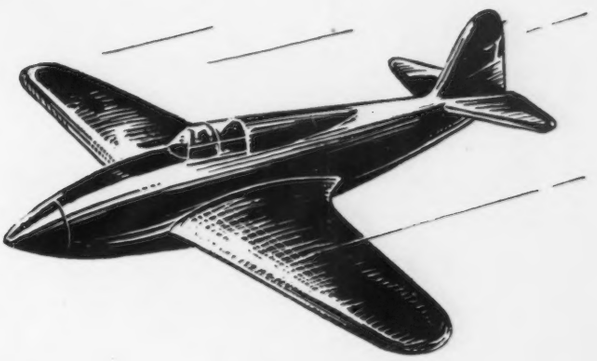

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tract to Southeastern Construction Co., 218 West Second Street, Charlotte, for two-story addition to lard refinery at 1801 North Brevard Street, Charlotte, for storage and distribution. Cost about $45,000 with equipment.

Southern Ornamental Iron Works, Inc., Arlington, Tex., plans expansion in metal specialties for defense program. Cost about $75,000 with equipment. Financing in that amount has been arranged through RFC.

Houston Lighting & Power Co., Fannin and Walker Streets, Houston, Tex., has plans for expansion in Deepwater steam-electric power plant, with installation of new 35,000-kw. turbine-generator unit and accessories, high-pressure boilers and auxiliary equipment; also will make extensions in transmission lines. Cost close to $7,500,000. Ebasco Services, Inc., 2 Rector Street, New York, is consulting engineer.

Central States

• **Apex Electrical Mfg. Co.**, 1070 East 152nd Street, Cleveland, electric washing machines and other electrical products, has let general contract to Bolton-Pratt Co., 1276 West Third Street, for one-story addition, 145 x 325 ft. Cost over $150,000 with equipment.

United States Engineer Office, Wright Field, Dayton, Ohio, will take bids soon on general contract for two-story repair, maintenance and service building, consisting of two sections, 380 x 420 ft., and 60 x 260 ft., respectively. Cost about $1,900,000 with equipment. J. Gordon Turnbull, Citizens' Buildings, Cleveland, is consulting engineer. General contract has been let to Frank Messer & Sons, Inc., 2815 Burnett Street, Cincinnati, for two-story aircraft laboratory and test building, 51 x 262 ft., with extension, 50 x 100 ft., at $325,951, exclusive of equipment.

Black Boring Machine Co., 4909 Luther Avenue, Cleveland, has let general contract to E. E. Lewis & Son, 1200 Green Road, for one-story addition, 50 x 150 ft. Cost over $60,000 with equipment.

Globe Machine & Stamping Co., 1250 West Seventy-sixth Street, Cleveland, sheet metal stampings, tumbling barrels, etc., plans one-story addition and improvements in present plant. Cost close to $50,000 with equipment. McGeorge & Hargett, 9400 Quincy Street, are consulting engineers.

Chase Drier & Chemical Co., 3505 Smallman Avenue, Pittsburgh, chemical specialties, driers for paints, varnishes, etc., will remove plant to Bedford, Ohio, where one-story building has been built to provide increase in present capacity. Company is a subsidiary of Ferro Enamel Corp., Cleveland.

Industrial Machinery Co., 369 Dublin Road, Columbus, Ohio, machinery and parts, has let general contract to Fred Kreutz, 109 Mithoff Street, for one-story building, 40 x 107 ft., for storage and distribution. Cost close to $40,000 with equipment.

Timken Roller Bearing Co., 1835 Dueber Avenue, S. W., Canton, Ohio, is erecting new boiler house, for which general contract recently was let to Gibbons-Grabble Co., Mellett Building. Cost about $100,000 with equipment.

Bridgeport Brass Co., Bridgeport, Conn., which is establishing new plant at Indianapolis for production of cartridge cases for government, will install additional machinery for increase in initial estimated capacity. Fund of $820,000 has been secured through Defense Plant Corp., Washington, in addition to a previous appropriation of $11,500,000.

Studebaker Corp., South Bend, Ind., has let general contract to Charles R. Wermuth & Sons, Inc., 1036 St. Marys Streets, for one-story addition for oil storage and distribution, and allied service. Cost close to $50,000 with equipment.

Board of Education, St. Louis County Schools, 20 South Central Street, Clayton, Mo., Rufus G. Russell, superintendent, plans one-story vocational training school on Page Avenue for defense workers in neighboring industries, including foundry, machine shop, etc. Cost about $66,100. Financing is being arranged through Federal aid.

George A. Breon & Co., Inc., 2405 Grand Avenue, Kansas City, Mo., industrial chemicals, etc., has let general contract to Fogel Construction Co., Reliance Building, for three-story addition, 30 x 116 ft. Cost over $70,000 with equipment.

J-M Service Corp., recently organized subsidiary of Johns-Manville Corp., 22 East Fortieth Street, New York, has begun superstructure for main buildings at new plant at Parsons, Kan., for production for government, and is awarding miscellaneous contracts. Plant will comprise one and multi-story buildings for shell-loading, with equipment for handling shells, bombs, fuses, boosters, detonators, etc.; also one-story machine shops, boiler plant, refrigerating plant and other structures, including administration building. It will be known as Kansas Ordnance Works and will cost $27,100,000, in which amount appropriation has been made by Defense Plant Corp., Washington. Consoer, Townsend & Quinlan, 211 West Wacker Drive, and Battey & Childs, 231 South LaSalle Street, both Chicago, are architects and engineers.

Jarecki Machine & Tool Co., Grand Rapids, Mich., screw presses, grinders, dies, etc., plans one-story addition. Cost over $50,000 with equipment. Robinson, Campau & Crowe, Grand Rapids, are architects.

Lyon, Inc., 197 South Waterman Avenue, Detroit, automobile rims and other automotive equipment, has let general contract to Cooper Construction Co., Maccabees Building, for new one-story plant, 200 x 500 ft. Cost close to $275,000 with equipment. Smith, Hinchman & Grylls, Marquette Building, are architects and engineers.

Vagabond Coach Mfg. Co., New Hudson, Mich., motor trailers and parts, plans rebuilding part of plant recently destroyed by fire. Loss over $100,000 with equipment.

Plymouth Division, Chrysler Corp., Detroit, will convert large section of main plant for mass fabrication of parts for army tanks now being built by parent company. Additional equipment will be installed. Cost over $400,000.

Odel Tool & Die Co., 8820 Grinnell Avenue, Detroit, plans one-story addition. Cost close to $45,000 with equipment. Frank Eurich, Jr., Detroit Savings Bank Building, is architect.

Continental Motors Corp., 12801 East Jefferson Avenue, Detroit, gas and gasoline engines, etc., will expand local plant for production of engine units for military tanks. Cost about $3,080,000, larger part of fund to be used for equipment. This is in addition to previous sum of $9,500,000 secured through Defense Plant Corp., Washington, for like purpose.

Spencer Kellogg & Sons, Inc., 2200 South Lumber Street, Chicago, linseed oil products, etc., has let general contract to James Stewart Corp., 343 South Dearborn Street, for three-story mill addition, about 44 x 100 ft., for processing, storage and distribution. Cost close to $40,000 with equipment. Walter E. Cowan, 542 North Taylor Avenue, is architect.

Socony-Vacuum Oil Co., 26 Broadway, New York, plans expansion at oil refinery at East St. Louis, Ill., including several one and multi-story units for new production division for toluene (benzal chloride), used in munition manufacture. Cost over $850,000 with equipment.

Bolens Products Co., Park Avenue, Port Washington, Wis., power lawn mowers, parts, etc., has approved plans for one-story L-shaped addition, 86 x 150 ft., and 75 x 96 ft. Cost over $70,000 with equipment. Walter E. Wendland, 621 North Twenty-ninth Street, Milwaukee, is architect.

Barnes-Duluth Shipbuilding Co., Duluth, Minn., plans expansion for construction of cargo vessels for government. Cost about $280,000, fund to be secured through Defense Plant Corp., Washington.

Municipal Light and Water Works, Paullina, Iowa, asks bids until Nov. 10 for new municipal power plant, including 400 to 450-bhp. diesel engine-generator unit and accessories. Cost about $85,000. Buell & Winter Engineering Co., Insurance Building, Sioux City, Iowa, is consulting engineer.

United States Engineer Office, Chicago, asks bids until Nov. 10 for 192 main roller bearing assemblies, 96 end guide rollers, 96 upstream guide rollers, bolts, nuts, lock washers, etc. (Circular 8).

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., is erecting a $350,000 addition for manufacture of naval gun sights for government, fund to be secured from Defense Plant Corp., Washington.

Amco Metals, Inc., Milwaukee, Amco metal and other bronzes, has plans for two additions, including machine shop, 120 x 120 ft., and forge shop, 100 x 100 ft., at a cost of $250,000.

Western States

• **Schnitzer Steel Products Co.**, 3330 N. W. Yeon Street, Portland, has acquired about 48 acres on N. W. Front Avenue on Columbia River, for new rolling mill, with storage and distributing buildings, power station and other structures. It will be operated by Oregon Electric Steel Rolling Mills, a subsidiary. Cost close to $1,000,000 with equipment.

Weber Showcase & Fixture Co., 5700 Avalon Boulevard, Los Angeles, metal store and bar fixtures, etc., porcelain-enameled specialties, has plans for one-story addition, 60 x 312 ft. Cost over $85,000 with equipment. Grant & Bruner, Ferguson Building, are architects.

Bureau of Reclamation, Denver, asks bids until Nov. 7 for two 82,500-kw. vertical shaft electric generators for Boulder hydroelectric generating station, Boulder Canyon project (Specification 1005).

Aluminum Co. of America, Inc., Gulf Building, Pittsburgh, is selecting site near Troutdale, Ore., for new aluminum reduction plant, production for government. It will consist of three main production units, each comprising one and multi-story buildings, with storage and distributing structures, power substation, machine shops, administration and other buildings. All machinery will be electrically-operated, power supply to be secured from Bonneville Power Administration, Portland, which will build transmission line to plant site. Entire project will cost $10,000,000, fund in that amount to be provided by Defense Plant Corp., Washington.

Welding Service Sales, Inc., 954 Howard Street, San Francisco, electric and acetylene welding, plans new one-story plant at San Carlos, Cal. Cost over $65,000 with equipment.

Pennsylvania Salt Mfg. Co., 2901 Taylor Way, Tacoma, Wash., has let general contract to Roy T. Earley Co., 411 North Eighteenth Street, for two one-story additions. Cost close to $75,000 with equipment.

Canada

• **National Steel Car Co., Ltd.**, Hamilton, Ont., is erecting one-story addition to main works at Malton airport, for which general contract recently was let to Tope Construction Co., Ltd., 677 Main Street West. Cost about $225,000 with equipment. H. H. Angus, 1221 Bay Street, Toronto, Ont., is consulting engineer.

Prairie Airways, Ltd., Moose Jaw Airport, Moose Jaw, Sask., has arranged with Department of National Defense for Air, Ottawa, Ont., for operation of new local plant, to be built by last noted agency, for assembling of military aircraft. Erection contract has been let to Carter-Halls-Aldinger, Ltd., Royal Bank Building, Winnipeg, Man., for one-story plant and auxiliary buildings. Cost close to $275,000 with equipment.

Canadian Allis-Chalmers, Ltd., St. Joseph Street, Lachine, Que., plans one-story addition. Cost close to $65,000 with equipment. T. Pringle & Son, Ltd., 485 McGill Street, Montreal, is architect.